

THE  
MINERAL WATERS  
OF  
SCHWALBACH.



M. L. Shaw -  
Schwalbach  
July  
1851





THE IRON WATERS  
OF  
SCHWALBACH.

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THE  
**iron waters of Schwalbach**  
(IN THE DUCHY OF NASSAU)

BY

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SCHWALBACH.

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## PREFACE.

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SINCE the period of their becoming more generally known, in the middle of the 16<sup>th</sup> century, the mineral springs of Schwalbach have been the subject of numerous publications; till the appearance of the present work, however, there has not existed any monography on these waters, written in the English language and intended exclusively for the Profession.

There can be no doubt that a work of the nature referred to is highly desirable. The epoch of semi-popular, semi-scientific balneographies, addressed equally to the great mass of the „Brunnen“ visiting Public and to the medical profession, has passed by; while, on the other

hand, the importance of the Schwalbach Minerals becomes from year to year more evident, and has already met with due appreciation on the other side of the Channel.

To supply this deficiency is the object of the following pages, which I hope will meet with a favourable reception from my professional brethren in the British dominions. Their indulgence, I must remark, is more particularly claimed for two of the chapters; namely, for that on the effects of our mineral water, and for the historical notices contained in the introduction. With regard to the effect of the springs — the explanation of which indeed is, and ever must be, hypothetical — the subject seemed of sufficient importance to warrant a minute investigation, this point having been entirely neglected in all earlier works on Schwalbach, although it is the only one that can furnish a scientific basis for the whole superstructure.

Should it be found, that the history of the springs is treated with a diffuseness hardly

compatible with the object of the work, I must advance the plea of an excusable partiality, together with the conviction that a Mineral, which during a period of three hundred years has attracted the attention of the most eminent members of the medical profession, possesses in its history the warrant of its intrinsic value.

Dr. GENTH.





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**BIBLIOGRAPHICAL**  
**AND**  
**HISTORICAL INTRODUCTION.**

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## Bibliographical and historical Notices of Schwalbach.

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THE works that have been written on Schwalbach, are very numerous. Without taking into account a multitude of articles, more or less diffuse, contained in general balneological publications and in periodicals, upwards of fifty monographies on our watering-place have come under my observation. Of these but very few were intended to meet the eye of foreign physicians; they are in a popular style, aiming at the amusement and information of the public during the use of the waters. They are composed in verse as well as in prose, and exist in the German, Latin, French, English, Dutch, and Danish languages; all of them bestow the most liberal encomiums on the valuable properties of the Schwalbach mineral water; some are even seasoned with piquant anecdotes taken from the gossip of the day. A large proportion of these publications have gone through five, and some as many as seven editions. The authors are almost all medical men, — from Worms, Wetzlar, Stuttgart, Ulm, Wittenberg, Darmstadt, Halle, Sobernheim, St. Goar, Butz-

bach, Idstein, Marburg, Giessen, Erlangen, and particularly from Frankfort-on-the-Maine. In the seventeenth century the most eminent physicians of the latter city bestowed on our springs the same degree of attention, that has recently been directed to the waters of Soden. —

Respecting the earliest history of Schwalbach, we possess but very indefinite information. Whether, according to Zueckert's opinion, a passage in Paul Wendroth's *Chronica Hass.* 1552 is to be taken as indicating the acquaintance of the Romans with our Weinbrunnen, is a question I leave to be decided by others. The words are: „*Catti occidentales contra Romanos ad Rhenum excursuri faunis suis in densissima silva Montis Tauni, quae eorum propugnaculum erat, adorationes et arma offerebant in Lucopatrum, ubi excubias agere solebant, inter thermas Mattiacas Tencterum et Aquas Vinarias Usipetum, tribus horis a Rheni ripa*“. Mons Tauni is supposed to be the high ground between Schwalbach and Wiesbaden, Lucus patrum the village of Hettenhain; *thermae Mattiac.* indicates Wiesbaden, while the *Tencteri* are thought to have been the inhabitants of the Wetterau, the *Usipeti* those of the Rhine-gau, and the *Aquae vinariae* the Weinbrunnen of Schwalbach. There is

nothing improbable in this conjecture: the great palisaded ditch (Pfahlgraben) passes very near our town, at Kemel and at Adolphseck, while in the surrounding country (Laufenselten, Holzhausen) Roman tombs are continually discovered. However this may be, it is an indubitable fact, that the Schwalbach springs up to the middle of the sixteenth century remained unknown beyond their immediate locality; since, in the first publications on Mineral Waters in general by Dr. Eschenreuter and Leonh. Thurneisen, works that for the times were very carefully composed, our wells are not mentioned. This omission is the more striking, as almost all the mineral springs on either side of the Rhine, beginning at its source and proceeding as far as Holland, are spoken of in succession, and among the rest our neighbours of Wiesbaden, Cronthal, and Ems. —

According to Wenk's account the origin of Schwalbach was in all probability a farm or grange situated on the banks of the Aar, and which by a deed of gift granted by a Duke Hermann of Franconia, dated 1138, was, together with certain vineyards at Camp on the Rhine, made over to the church of St. Goar. On the demise of the last Count of Arnstein, the jurisdiction over St. Goar having been obtained by the Counts of Catzenelnbogen,



Schwalbach with Nastaedten and Hilgenroth came into the possession of the latter. By the death of Philip the Elder, 1479, — whose daughter, Anna, had been united to the Landgrave Henry of Hessen, — the line of the Counts of Catzenelnbogen became extinct. At the division of the inheritance Schwalbach was allotted to the Landgraves of Hessen; and when, after the decease of Philip the Generous, whose name is so conspicuous in the history of the Reformation, the Hessian lands were divided among his four sons, in 1567, Schwalbach fell to the share of Philip the Second. The latter dying childless in 1584, his territories, as far as we are concerned, devolved to his brother, William the Fourth of Hesse-Cassel. Philip the Generous had established the protestant confession throughout his dominions; William the Fourth was also a zealous adherent to the doctrines of Luther. William was succeeded, in 1592, by his son Maurice the First, who adopted the Calvinist creed, and in 1608 introduced this confession into Schwalbach. In the Thirty Years' war, so fatal to Germany, Maurice took part with the Union, and fought under the banners of Gustavus Adolphus. As a punishment for his desertion of the Imperialists, and for the favour he showed towards the new doctrine, Ferdinand the Second of Austria, in



accordance with a decree of the Imperial Aulic Council at Vienna, 1623, deprived him of that portion of the county of Catzenelnbogen, in which Schwalbach was situated. Maurice opposed the execution of the decree, but was obliged to give way to a military occupation under the Spanish general Verdugo, and to surrender his claims to the Landgraves of Hessen-Darmstadt, Louis the Fifth and his son George the Second, who had remained faithful to the Imperial cause. Our watering-place thus came into the possession of Hessen-Darmstadt in 1626, and formed part of its territory till the year 1647. Maurice the First died in 1627, and was succeeded by William the Fifth, a prince distinguished for valour and for firmness of character. He was continually engaged in hostilities with Hessen-Darmstadt in order to the recovery of his rights, and at his death on the field of battle in 1637, his heroic consort, the Landgravine Amelia Elisabeth, continued the contest during the minority of her son, William the Sixth. Amelia took into her service the *ci-devant* Swedish general, Mortaigne de Portalis, and gave him the commission to recover the territory of Catzenelnbogen by force of arms. Within a very short period Mortaigne made himself master of all the strongholds and castles in the above-men-

tioned district; and it was on one of these occasions that Hohenstein, of which more hereafter, was destroyed. In 1648 the Landgravine Amelia concluded an arrangement with Darmstadt, by which it was agreed that Schwalbach should again become subject to Hessen-Cassel. In the very same year, Cassel made over our watering-place to the Landgrave Ernest of Hessen-Rothenburg, who resided in Schwalbach; in this transfer, however, Cassel reserved its right of lord paramount. In 1652 the Landgrave Ernest formally adopted the Romish creed at Cologne, and re-established a catholic community in our town and dependencies. Schwalbach remained in the possession of the family of Rothenburg till 1816, at which epoch, by virtue of a convention, it was incorporated with the Duchy of Nassau.

I now take the liberty of offering to the reader a few short notices of the history of our mineral springs. This may be divided into three Periods:

## First Period: — Tabernaemontanus.

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The first authentic information respecting our mineral springs dates from the year 1568, and is written by Dr. Jacob Theodor at Worms, under the name of Tabernaemontanus, (from his birth-place Bergzabern). This celebrated physician accompanied in the above-mentioned year the then Bishop of Spire (Marquard) to Frankfort o. M., whither the latter had been sent as a deputy by the Emperor Maximilian the Second. The bishop had long been a sufferer from the colic. During his stay in Frankfort Tabernaemontanus was summoned to attend the brother of the Elector of Mentz, who was likewise tormented by violent pains of the same nature. Both patients had been recommended to use the mineral water of Vilbel, a village situated between Frankfort and Friedberg; but the experiment was not attended with any alleviation of the complaint. While in Mentz Tabernaemontanus happened to hear from a peasant who had come from the neighbourhood of Schwalbach, that at the latter place there was a mineral spring — the Weinbrunnen — the water of which, used

internally, quickly removed the pains of the colic. He instantly took measures to have a number of stone-bottles filled at the spring in question, and conveyed to Mentz. The Elector's brother made the trial, and though water of all kinds had hitherto disagreed with him, was perfectly able to support the mineral of Schwalbach. His colic was gradually relieved, and in a short time entirely removed. Upon this, the physician tried the same water upon his other patient, the bishop, and the success was equal to that of the former case. Tabernaemontanus himself suffered from the colic (probably colica saturnina), in consequence of having partaken of an adulterated wine. He too was within a very short period delivered from this troublesome complaint, by using the water of the Weinbrunnen.

Hereupon, Tabernaemontanus began a systematic course of observation upon the effects of the mineral in question. He not only employed it at the well itself, but also caused it to be transported to patients at a distance; thus he was soon enabled to convince himself of its great medicinal virtues. — At length, 1581 after a trial of thirteen years, he made public the results of his investigations in a work entitled „Neuer Wasserschatz“ (new water-treasure). In this book, all the mineral springs in Germany at that time

known, are enumerated, but among these, the author, in his quaint language, distinguishes the Weinbrunnen as the „noblest, most excellent and healing“ of all the other mineral springs. In addition to the Weinbrunnen, nine other of the Schwalbach sources are mentioned in the above work: most of these are in existence at the present day, as for instance, the Brodelbrunnen (Bubble-well), Lindenbrunnen etc. in the lower part of the town.

The warm recommendations of a practitioner so influential as Tabernaemontanus, united with the success of the first striking cures in families of such consideration as those of an elector of Mentz and a bishop of Spire, had the effect of rapidly spreading the reputation of our springs.

The work of Tabernaemontanus met with a ready sale, so that a seventh edition became necessary within a very short period, and the increase in the number of visitors to the wells was so considerable, that von Hoernigk, writing in the middle of the seventeenth century, says: „many hundred, nay even thousand persons of high and low degree do annually visit and use the Weinbrunnen for the purpose of praeservation and curation!“

Although Tabernaemontanus expressly states that all the springs of Schwalbach may be employed in



medical treatment, yet only the Weinbrunnen and the Brodelbrunnen were at first made use of, the former internally and the latter for baths. Bathing, however, was but seldom resorted to, as this mode of applying the waters was deemed suitable only for external complaints.

In his efforts to promote the prosperity of the nascent watering-place the worthy Tabernaemontanus was powerfully seconded by the Landgraves of Hesse, who soon obtained the proprietorship of most of the springs. The Landgraves Louis, George of Hesse-Darmstadt, and Ernest of Hesse-Rothenburg, in particular did their utmost to advance the interests of Schwalbach. Louis caused the roads to be improved, public walks to be laid out, and a number of buildings to be erected, destined to the accommodation of visitors, and provided with inscriptions, which in part exist at the present day. The Weinbrunnen was enclosed by order of the Landgrave George, who also had several arbours placed round it, to afford temporary shelter in unfavourable weather. Landgrave Ernest erected in the vicinity of the well a building that served at once the purposes of a drinking-hall and a gaming-room; and it was he who planted the still existing avenue of horn-beams, be-

hind the Alléesaal. (These trees are, therefore, about 200 years old )

Schwalbach was also indebted for many improvements to the Counts Adolphus and Ernest of Solms, who had the Schwenkbrunnen (close to the Weinbrunnen) enclosed, and the promenade grounds enlarged and embellished.

The extensive reputation, to which the Weinbrunnen very soon attained, both on account of its medicinal properties and of its agreeable taste, not only attracted visitors to the spring, but occasioned the water to be exported in considerable quantities to all parts of Germany, and even to several foreign countries. According to Winkelmann the principal consignments were to Nuremberg, Leipsic, Prague, Silesia, Switzerland, and France. It was used, as Selters water is at present, to form an effervescing beverage in conjunction with wine and sugar. What an important article of local commerce this water had become in the seventeenth and eighteenth centuries is evident from a passage in Schloezer's „Staatsanzeigen“, in which it is affirmed that „in his time during the summer months, one day with the other, from eight to ten thousand stone-bottles were sent off daily; that even in the winter months

the export continued, though in less quantity“, and that „several hundred carriers obtained their livelihood solely by the conveyance of this article“. The water was transported in casks, as well as in stone and glass bottles. To Amsterdam and Hamburgh it was sent in butts, and was frequently on such occasions mixed with wine, as it was supposed, that the water thereby retained its freshness for a longer period.

Particular attention was devoted to the filling of the bottles etc., and to the method of conveyance. Tabernaemontanus himself gives explicit directions on these heads, and later writers allot a special chapter to the subject.

The few baths that were taken during the first period of the vogue of our waters were, as already stated, prepared exclusively with the water of the Brodelbrunnen. Up to the commencement of the seventeenth century, these baths were obliged to be taken at the dwelling of the patient; but, at the period referred to, some enterprising individuals erected two small bathing houses in the vicinity of the Brodel spring. To one of these the water was conveyed by hand; to the other, it was conducted through pipes directly from the well. The proprietor of this latter



establishment paid the owner of the spring a yearly rent of three shillings.

As the quantity of water furnished by the Brodelbrunnen was inconsiderable, the want of an additional source of supply for bathing purposes soon began to make itself felt. Accordingly, diggings were commenced in the immediate neighbourhood of the Brodelbrunnen, and in a short time (1629) a spring similar to the former, and which received the name of Neuer Brodelbrunnen, rose to the surface. At the invitation of Landgrave George of Hesse, the newly discovered water was subjected to the examination of the medical faculty of the university at Marburg. For some reasons, however, at present unknown, the new spring was filled up again as early as 1656. Judging by Merian's plan, it was situated a few paces below the present Brodelbrunnen. —

In spite of the endeavours of Tabernaemontanus, to restrict the use of the baths to a small number of „outward ills and defects“, yet they soon began to be more generally employed, after Horstius, Dictericus, and particularly Hoernigk had specified the diseases, for which the Brodelbrunnen baths were applicable. In accordance with the medical ideas prevalent at the time, which sought for efficacy by a diversity of compounds, the baths were mixed with

all sorts of herbal infusions. An adjection very much in favour was that of the Schlangenbad water.

In 1694 the Weinbrunnen, which till then had been merely encircled with a wooden railing, was by orders of the Landgrave of Hessen-Cassel provided with a new basin and set round with hewn stones, ornamented with the landgravial arms. During the progress of the work, it seems that the spring ceased to flow, and Schweitzer assures us, that the water did not re-appear, „till after much labour and fervent prayer.“

Besides Tabernaemontanus the following authors wrote on Schwalbach during the course of the seventeenth century: Salzmann, Sennertus at Wittenberg, Dietericus at Darmstadt, von Hörnigk and Horstius at Frankfort, Geilfusius, Waldschmid, Cardilucius, Valentinus, Niesen in Butzbach, Jormann in Frankfort, Melchior in Idstein, Gladbach in Frankfort, Guckelin, and Merian. Of this last we possess a fine view of Schwalbach, executed in copper-plate and dated 1631; it was taken from the west side, and represents the Weinbrunnen and some of the principal buildings very conspicuously. Merian also gives a description, accompanied with a drawing, of Adolphseck and

Hohenstein. A publication by Dietericus and Horstius likewise contains an engraving exhibiting the Weinbrunnen.

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### Second Period: —

**Schwalbach one of the most fashionable baths of Germany. — Friedrich Hoffmann.**

We do not possess any exact accounts respecting the frequentation of our watering-place in earlier times; but, from the balneological works still extant it is evident, that Schwalbach, from being at first visited as a mere medicinal spring, very soon attained the rank of one of the most fashionable baths of Germany. During what we term the first period of its existence the majority of the guests was derived from the population of the surrounding country; but it was not long before more distant towns and states also furnished their contingent of visitors. Beside the wealthy merchant of Frankfort, whose yearly budget always contained an item for Schwalbach expenses; beside the portly priest of Mentz, whose favourite places of repose and recreation were Schwalbach and Schlan-

genbad, — were to be seen a number of the most distinguished personages of the time. Thus, we find that in 1628 Fieldmarshal Count Tilly went through a course of the Schwalbach waters. He came from Wiesbaden, where he had been stopping on account of the baths; a document, still preserved in the archives of Idstein, states, that Tilly in the course of a few weeks occasioned the town of Wiesbaden an outlay of 840 dollars. Whether Schwalbach was subjected to the same expenses, is not mentioned in the record referred to. —

In 1651 the celebrated engraver in copper, Merian, passed some time at Schwalbach, where he eventually died. According to his statement, Philip William, Count Palatine on Rhine and Duke of Bavaria was in the above year united to the Landgravine Amelia of Hessen-Darmstadt, and the nuptials were solemnised in Schwalbach. Lehmann, in his historical „Remarques“, relates that, „in the July of 1701 the waters had been taken at Schwalbach by „her Majesty the Queen Dowager of Denmark & Norway, his Serene Highness the Regnant Landgrave of Hessen-Cassel, the Hessian Fieldmarshal Count Augustus of Lippe, his Excellency the Stadtholder Gueldenloew“, etc. —

In the description of Hessen, Winkelmann asserts, that at the commencement of the eighteenth century Schwalbach was constantly frequented by persons of the most exalted rank, both native and foreign; and, that in July 1711 he found staying here, at the same time, eleven princes and fifteen counts.

These statements of Winkelmann and Lehmann, regarding the class of society, by which our waters were more particularly frequented in the first part of the foregoing century, are confirmed by the testimony of a work that appeared at Liège in 1738, entitled:

**Amusemens des Eaux de Schwalbach, des Bains de Wiesbaden et de Schlangenbad.**

It is supposed to have been written by a Frenchman, named Merveilleux, and presents a very animated picture of the season at Schwalbach and Schlangenbad. The author affirms that, at times, „from five to six hundred cavaliers and dames of high degree, besides several thousand persons of inferior rank“, were congregated at Schwalbach. As being regular visitors are mentioned, the prince of Nassau-Weilburg and the prince of Thurn & Taxis, who every summer migrated to Schwalbach, with their whole households. Both princes, in conjunction



with the resident Landgrave of Hessen-Rothenburg, did the honours of the place during the season. From sixty to eighty guests were daily seated at their tables, and took care to do ample credit to the sumptuous viands and particularly (remarks the writer) to the delicious Rhine-wines of their entertainer. The princes were attended not only by their private bands or chapels, consisting of sixty persons, but also by both their opera companies. As may be supposed there was no lack of concerts and balls; a peculiarity of the latter, recorded in the „Amusemens“, deserves to be noticed: — „at these balls only those of noble birth were allowed to dance; the others remained standing behind the rows of chairs“. „Every other day, there was a concert, ball, or opera“. — It seems that, in addition to these entertainments, there was also a troop of German actors here, by whom comedies and farces were performed for the delectation of the public. — Games of hazard were carried on in Schwalbach on a still larger scale, than at Baden and Homburg in our days. In the publication cited above, we find, that in the large playing saloon as many as thirty gaming tables were sometimes to be seen, and all of them so crowded, as to render it very difficult to obtain even standing room. The greatest diversity prevailed in the amount

of the stakes, which varied from a few pence to handful of untold gold. Even while taking the waters at the Weinbrunnen, the public were accustomed to game; and for this particular object, a building was erected in the neighbourhood of the spring by the Landgrave Ernest. The gaming tables were visited by ladies, as well as gentlemen; and the author of the „Amusemens“ ascribes, with justice, to this pernicious pastime, the frequent ill-success of the mineral treatment.

Among other diversions for the Brunnen-visiting public, we find especial note made of a band of music, all the members of which were Jews. Their harmony is recorded to have been particularly favourable to the digestion of the water, for they performed at the tables d'hôte and at the well. They were also the musicians at the balls, nor did their functions stop here, as they are reported to have filled up their time by giving instruction in dancing to the nobility and gentry.

Besides the above-mentioned amusements, we read of grand hunts, rifle-shooting, excursions to Schlangenbad <sup>1)</sup>, Adolfseck <sup>2)</sup>, Hohen-

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<sup>1)</sup> Schlangenbad (Serpents' bath) has been known as a Bath since 1657. In spite of the break-neck road (the beginning of which is still to be seen behind the Post) leading thither from

stein <sup>3)</sup>, and particularly to Idstein, whose beautiful church formed a constant attraction to our guests.

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Schwalbach, there was always a lively intercourse between the two places; and this, as a matter of course, increased as soon as the new road was finished. — Schlangenbad and Schwalbach have ever been considered as standing in a certain relation to each other, and in most publications on Mineral Waters, are even discussed in common. Many of our guests were in the habit of resorting to Schlangenbad for the benefit of the baths, or they had the Schlangenbad waters conveyed to Schwalbach; while, on the other hand, several who had gone through a term of bathing, now came to take an internal course at the Weinbrunnen. This intercourse continues, more or less, to the present day, and not merely in compliance with medical prescription, but also to pass a pleasant afternoon in the arbours of the neighbouring Naiad.

2) Respecting the period at which the castle of Adolfsceck was built, opinions vary. Some ascribe it to the Emperor Adolphus, who belonged to the House of Nassau; he is said to have erected this stronghold, as a residence for his consort Imagina during the wars with Albert of Austria. — According to other accounts, this castle dates from 1355, and was used by its founder, Count Adolphus of Nassau, and his successors as a summer residence. In the war of Thirty Years Adolfsceck was destroyed, a fate shared by the castle of Hohenstein.

3) The castle of Hohenstein was erected in the twelfth century by the Counts of Katzenelnbogen, who thence are mentioned, as early as 1190, under the name of Hohnstein. It was long their family castle.



Concerts, balls, operas, and gaming, took place in the present Alleesaal, at that time called Leppert's house. The building, — half the size of the existing one of this name — was surrounded with a balcony on the first floor, as in the Swiss houses; and when the weather was fine, it was in this balcony that some of the gambling-tables were placed. The balls and concerts were held in the large saloon in the first story, whither also the play-tables were removed in bad weather. The Opera house, or rather room, was on the ground floor. —

Under such circumstances, it is not astonishing to find that particular attention was devoted to the toilette. We read that, „at Schwalbach both gentlemen and ladies display all their finery. Whatever they may possess of summer or winter clothing, fine linen, and jewels, — everything is brought out at balls and concerts, offering a spectacle most splendid to behold. High festivals, as also the birth-days of those princes who may happen to be residing there, are kept in Schwalbach as gala-days.“ The luxurious life led at this watering-place attracted speculating traders from Frankfort, Nurenberg, Paris, Brussels, Italy, and jewellers from Geneva. These were located in booths near the Weinbrunnen and the gaming-rooms, and are reported to have done considerable business.

Our authority informs us, moreover, that in the eighteenth century the dwelling-houses at Schwalbach were far superior to those of Wiesbaden <sup>1)</sup>).

With regard to the division of the day, it seems that at 6—7 in the morning the wells were frequented, and as the prints of the time show, en grande tenue, in periwig and farthingale. Some-

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<sup>1)</sup> On nearer examination, it appears that Schwalbach, originating at the Aarbach, has gradually elongated itself in two rows of houses by the side of the Muenzbach, as far as the Stahl- and Wein-Brunnens, a distance of more than one English mile. Of the lower and most ancient portion of the town nothing remains, it having been burnt down in 1632. The style of the buildings still existing in the old town, however, indicates both its age and rapid increase. In the vicinity of the Brodelbrunnen there are yet to be found a number of houses, profusely decorated with carved work, and bearing the dates 1606 and 1630; and we see already by Merian's plan of 1631, that a considerable portion of the buildings was situated near the Weinbrunnen. About twenty years ago, the inscription indicating the residence of the Landgrave George was still to be seen. Both he and the Elector of Mentz always lodged at the „Swan“, a little above the Brodelbrunnen; over the principal entrance were the arms of the Landgrave and his consort, together with their names and titles. Besides the „Swan“, the houses of greatest repute were the „Bretzel“, the „Sonne“, the „Riesen“, the „Glocke“ and the „Rebstock“. It is much to be regretted, that these singular constructions have latterly been modernised.

what remarkable is the fact, that, for the avoidance of disputes (i. e. immediate settling of the same), the regulations of the place forbade the wearing of swords. A particular space at the well was marked off for the Jews, and was even indicated by an inscription. Seven till nine o'clock were the hours for bathing. — One of the most important occupations of the day was furnished by the dinner, which generally took place at 11 in the forenoon. After this meal the public dispersed in the Allée, the large gaming saloon near it, or resorted to a smaller room in the lower part of the town, where the stakes were generally less than at the other establishment. — The afternoons were employed in excursions to neighbouring points of attraction. On the return, towards evening, it was customary to call at what was termed the Schwalbach Exchange (Schwalbacher Boerse). According to Lehmann, this consisted in an open place between the „Weidenhof“ and the „Golden Chain“ <sup>1)</sup> hotel, and coincides with the present market-place. Our authority affirms that

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<sup>1)</sup> The „Goldene Kette (Golden Chain)“ is situated in the middle of the town, and was formerly one of the most renowned houses of entertainment. The building is rendered very striking by its antique galleries and projecting windows; it has very frequently afforded a subject for the pencils of visitors and tourists, especially of the English.

it was seldom to be found empty, and was the grand emporium of Schwalbach for news, gossip, and scandal.

With respect to the propriety of drinking the mineral water in the evening, some authors mention it as allowable, but in very small quantities, whilst others state it to be highly objectionable. — Supper was taken usually at 6—7, after which the ball, concert, the comedy, or the opera was visited. Ten was the general hour for retiring to rest. —

In a word, our seasons in the last century were periods of noise and bustle, presupposing the possession of stout nerves on the part of the bathing-guests. In corroboration of this statement, we need only refer to the method practised to announce the approaching arrival of a stranger. In the „Amusemens“ we find „that in order to let the townspeople etc. know, when a stranger of any distinction was approaching, an old soldier had constructed a miniature fort on an eminence, and as soon as he perceived an equipage or a rider on any of the roads leading to the town, he fired some small cannon on that side from which the stranger was to be expected.“

Whilst the author of the *Amusemens des Eaux de Schwalbach* (which a year after its appearance was translated into German) was powerfully contribut-

ing to establish the reputation of our bath by his glowing descriptions of its pleasures, one of the first physicians of the time entered the lists, as the champion of the efficacy of the Schwalbach mineral. Friedrich Hoffmann a celebrated professor at the university of Halle, to whose efforts it may principally be ascribed that the doctrine of the efficaciousness of mineral waters obtained footing among the medical world in general, published in 1730 a little work entitled: „De fontis Spadani et Schwalbacensis convenientia.

Halle 1730.

In this treatise the author draws a parallel between the springs of Schwalbach and Spa, accounts for the difference of their effects by a careful investigation of their chymical contents, and thence deduces the indications for their use. Hoffmann's influential recommendation secured to Schwalbach a yearly caravan of invalids, who sought relief or cure from its beneficent Naiad. The professor concludes his notices with the following words: „From all these careful experiments it is evident, that our mineral springs surpass many, and even the most of those that are to be found in Germany, — in lightness, subtilty, and purity; and it is to be supposed that no one, unless from ignorance or envy, will deny that these waters possess the greatest virtues for the treatment of most diseases.“ —



Besides the Weinbrunnen and the Brodelbrunnen, in the year 1740 the Stahlbrunnen, or Steel-well, began to be employed. Tabernaemontanus had already made mention of this spring, but under another denomination; its present name it received from a physician of Wetzlar, called Schweitzer, who, on carefully examining the water, was of opinion that it contained more iron, than that of any of the other springs here.

In addition to those already specified, another spring, termed the Börner Brunnen, came into request at the period referred to. It was situated below Schwalbach, in a meadow on this side of the Aar. A house was built for the accommodation of visitors, and a depot for the sale of the water established in Wiesbaden. The speculation, however, did not succeed. — The spring contains a considerable quantity of iron and carbonic acid, but has fallen into complete disuse. Ritter notices it in his memoirs, and even commemorates its fall in a poem. — In the course of the eighteenth century, publications of different kinds, respecting the waters of Schwalbach, made their appearance. As the writers of these we find the names of Melchior, Lehmann, Moeller, Schellhammer, Hensing, J. Ph. Hofmann, Ruebel, Pasquay, Razen, Thilenius, Forst.

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### Third Period: — Nineteenth Century. —

#### Fenner von Fenneberg.

In the annual number of visitors at a watering place the greatest fluctuations may be observed. The fortune of the season depends sometimes on the favour of a great personage, sometimes on the successful treatment or general satisfaction of the guests in the preceding year; it is also influenced by the prevailing character of disease, and is pre-eminently affected by the appearance of the political horizon. Thus Schwalbach, after a period of prosperity that lasted two full centuries, had to experience a melancholy reverse. The consequences of the French Revolution were particularly fatal to the German watering-places; and among others to Schwalbach, which, lying half-way between the fortresses of Mentz and Coblenze, was continually exposed to the passage of troops. This was made still more burdensome for our town, says Fenner, from an erroneous supposition on the part of the French, that the district of Katzenelnbogen belonged to Nassau, whose prince, Frederic-August of Nassau-Usingen, was at that time serving as a general in the Austrian army. Fenner represents our Bath at the period of his arrival (1798), as perfectly desolate. In his flowery style he tells us, that „not a stranger, thirsting after

health, was to be seen sauntering under our venerable beeches and limes, while, untasted the bubbling springs exhaled their ether in the glittering rays of the morning sun. No cheering music enlivened the silent vale, no morning salutes were interchanged; the listless guardians of the wells, — of yore so stirring and busy, — now with tragic mien pledged each other in unpaid beakers; whilst, from time to time, a poor wearied French or Austrian soldier, as the chance of war might be, would straggle to the enclosure of the purling fountain, and quaff renewed strength from the inspiring source."

This period of decline was, fortunately, not of long duration. The clouds that had been lowering over Schwalbach began to disperse as soon as the tumult of war, which had almost depopulated the Rhenish Baths, was removed to a distant theatre: but it was not till after the great catastrophe of 1815, that the sun burst forth in all his splendour. From this period we may date a new epoch of prosperity for our watering-place. It did not, indeed, again attain to the rank of a favourite resort of fashion and folly, but at once took up an honourable position among the first-rate medicinal waters of Europe, a position, which it undoubtably still maintains. —

And is this a change that is to be regretted? The answer must certainly be in the negative. Almost



all the larger bathing-places have ceased to be a retreat for quiet recreation, for repose from the excitement and wear of professional or conventional life. On the contrary, they have become the haunts of noisy pleasure and thoughtless dissipation. The development of Schwalbach, as also that of its neighbour, the pastoral Schlangenbad, has been in an inverse direction. A hundred years ago the beau monde selected these two spots for the gratification of their frivolities, or their passion for play; at present, a society, not less polished than that of yore, flocks thither to escape from conventional thralldom, for a short time to live in accordance with the dictates of Nature, and to lay up a fresh stock of health and spirits for the trials and fatigues of life. This altered state of things is undoubtedly in every way to the advantage of Schwalbach. The prosperity of the place is no longer dependent on the caprices of fortune, but rests on a natural basis: it will continue as long as the mineral waters flow, and humanity stand in need of restoratives.

It is with the sincerest pleasure, that the deserts of a man, to whom Schwalbach owes much of its present reputation, are recorded in these pages. The individual referred to, is Dr. Fenner von Fenneberg, who died here a few years ago. —

Henry Fenner von Fenneberg came hither from Marburg in 1798 at the particular recommendation of Baldinger, and was, properly speaking, the first bath-physician of Schwalbach. Provided with a rich store of medical and general knowledge, animated with the best intentions, indefatigable in exertion and experienced in society, he was just the man to bring a neglected watering-place again into public favour. During a period of activity extending over fifty years, Fenner devoted all his energies, and a not inconsiderable portion of his worldly means, to the interests of our Bath. He lived to enjoy the satisfaction of seeing that his efforts had not been unavailing. — It does not enter into the province of the present work, to detail the changes brought about in the local circumstances of Schwalbach by the instrumentality of Dr. Fenner; it will suffice, to notice two branches of his activity: — his literary productions and the reorganisation of our bath-arrangements. —

Numerous as were the works on Schwalbach that had been published before Fenner's time, the contents of the great majority were in the highest degree either of an extravagant or an insipid character. All sorts of speculative notions about the elemental powers of the waters are to be met with on one hand; on the

other the most vapid observations on the efficacy of the springs. Any attempt at a scientific estimation of their medicinal value is seldom to be found, and whenever it occurs, is almost always grounded on a false view of the chymical composition and effect of the water, leading naturally to an erroneous conclusion with regard to the indications and use. The vitriol, amber, orpiment, bitumen, and sulphur of Tabernaemontanus had, indeed, yielded already to the careful investigations of Hensing and Fredr. Hoffmann; but it was reserved for Gaertner, Ritter Buchholz, Wedekind, Rube, and more particularly for Kastner, to ascertain the chymical and physical peculiarities of the Schwalbach mineral. With the utmost discrimination, Fenner availed himself of the materials thus offered to him; and from them, as well as from the results of unbiassed and copious observations, he deduced the sphere of operation attributable to each of our springs. His writings are almost all couched in a popular style, invariably clothed in a diction by far too poetic; nevertheless, they bear the stamp of sincere conviction, and of a genuine talent of observation. If any objection is to be made to the scientific portion of his task, it may perhaps be founded on his having given too wide a scope to the operative powers of our mineral waters.

In addition to a number of papers, dispersed in various periodicals, Fenner gave to the world no less than twelve special works, on the springs of Schwalbach. The scientific value of these publications has met with general acknowledgement, and, as they have been translated into several languages, they have borne the name of our waters far beyond the frontiers of Germany <sup>1</sup>).

It may not be going too far, however, to say that Fenner deserves equal credit for the radical reform he introduced in the method of preparing the baths.

The fact is somewhat extraordinary, that up to the conclusion of the eighteenth century the water of the Brodelbrunnen alone was used for the purpose of bathing. In Hoernigk's times this water was, as already stated, not only conducted into a house situated near the spring, but was also, and in the majority of cases, carried to the patient's dwelling, and there mixed with warm water. After this practice had been continued during two hundred years, and when the improved state of chymical science had demonstrated, that the water of the Brodelbrunnen contained not a

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<sup>1</sup>) Contemporary with Fenner, — Drs. Lehr, Diehl, and Thilenius distinguished themselves as bath-physicians at Wiesbaden and Ems.

trace of iron, and a very insignificant quantity of carbonic acid, — the thought at length presented itself, that the two iron springs, the Wein- and Stahl-Brunnen, might be employed externally. With timid caution, the new water was at first mixed with a large proportion of the favourite Brodel; by degrees larger quantities of steel water were used; at last, Fenner, encouraged by the successful results already obtained, set aside the Brodelbrunnen altogether. Still more injudicious, however, than the choice of the spring that supplied the water, had been the preparation of the baths themselves. Fenner tells us, that at a certain, or rather an uncertain hour of the morning, a horde of dirty women, armed with tubs and vats, tramped into the rooms of the patients, and there compounded a vile mixture, that was dignified with the name of a steel bath. There was no control with regard to the delivery of the particular water that had been prescribed; the fluid was carried about in uncovered vessels, as if to let the precious ether exhale as soon as possible; and to crown the whole, one of the more knowing crones plunged her sooty arms into the villainous compound, and took it upon herself to fix the temperature. With all confidence in his oracle (and the arm-thermometer), the patient entered his bath, and got through it as best he might; too hot or



too cold, reclamations and exclamations were of no avail; the busy crew were gone, intent on preparing the same lot for some other unhappy subject.

Such a state of things was to be remedied only by the establishment of a public institution. The necessity of such a measure had been acknowledged long before by the Hessen-Rothenburg government, and shortly after 1780 a plan had been completed, and even a portion of the building materials brought together; the execution of the project was, however, thwarted by an objection on the part of Hesse-Cassel, which thought fit to insist on its right of sovereignty.

Fenner employed all his influence with the Duke William of Nassau, — who was not insensible of the advantages likely to accrue to the country from the development of its bathing-establishments, — to induce this prince to supply the long-felt requirement. His efforts were successful, and in 1828 the present handsome edifice was erected, of which it may be said, that in convenience and propriety of arrangement, it is not equalled by any other similar establishment in Germany. Duke William, whose health occasioned him to visit Schwalbach several seasons, did not confine his patronage to the erection of a bathing-house, but extended his beneficial influence to all the arrangements of the place. The Board of ma-

nagement underwent considerable reforms, the public promenades were extended and embellished, new buildings erected, an improved method of filling adopted, the springs subjected to a careful analysis; while the communication with Ems, Schlangenbad, and the Rhine, was facilitated by the construction of excellent roads <sup>1</sup>).

The existence of the new bathing-house entailed the necessity of a more copious supply of mineral water, the Stahl- and Wein-Brunnen not furnishing a sufficient quantity. Endeavours were, therefore, made to discover a former spring, situated in the same valley as the Weinbrunnen, but which had gradually disappeared. After diggings had been undertaken in several places, these efforts were attended with success, and the Paulinenbrunnen was brought to light. Fenner particularly interested himself for the new-born Naiad, and wrote two pamphlets, to obtain for it a firm footing in the Schwalbach pharmacopoeia. —

As had been the case at an earlier period, some of the most eminent practitioners of the time

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<sup>1</sup>) Schwalbach was not alone the object of the Duke's favour; all the mineral baths of Nassau exhibit unequivocal traces of his active mind and powerful protection. It was his aim to develop the rich treasure of the medicinal springs of Nassau, and to benefit at once both his own subjects and suffering humanity.



again directed their special attention to Schwalbach. As distinguishing themselves in this respect F e n n e r gratefully mentions the names of Stieglitz in Hanover, H u f e l a n d and H o r n in Berlin, of W a l t h e r in Munich, S t i e f e l b e r g e r in Basle, S u e r m a n n in Utrecht, K o r e f f in Paris, C h a u f f i é in Hamburg, etc. —

There is still another name to be mentioned in these pages, — that of a man, to whom not only Schwalbach, but all the watering-places of Nassau are under great obligations. In 1832 Sir Francis Head passed nearly two months at our waters. From his homely lodgings in the Hôtel d'Angleterre he made daily excursions into the surrounding country, and thus collected a rich fund of materials for his „Bubbles from the Brunnens of Nassau,“ published at London in the ensuing year. The humorous and spirituel treatment of his subject, together with his animated description of the peculiar advantages of our local arrangements, had the effect of causing a number of his countrymen to visit us already in the very first year after the publication of the work. Ever since the period in question (1834) the stream of visitors has not ceased to flow, not alone to Schwalbach, but to all the baths of the Taunus, and by the people of our town the remembrance of the „old man“ is still cherished with affectionate regard.

Of those who have written on our waters in the present century are to be mentioned: J. Fenner, a brother to our bath-physician, Ritter, Fischer, von Wedekind, and Karstner. This last analysed all our springs twice; the first time in 1828 and 1829 and again in 1839 and 1840. A fresh analysis is at the present moment, being undertaken by Dr. Fresenius, of Wiesbaden. —

It has been remarked above, that Fenner has given rather too wide a scope to the operative powers of our mineral water. This objection is applicable to almost all works on mineral waters that appeared about his time, and, in a higher degree, to those that were published in the earlier periods. The authors of the latter, especially, were firmly convinced, that they infallibly promoted the prosperity of their respective baths by lengthening to the utmost limits the list of diseases that might expect a cure at that particular water. This system naturally led to encroachments on the domains of other minerals. Measures of reprisal were adopted, and the consequence was, that in every balneological work of the period, — however heterogeneous the waters treated of, — we meet with a register of the very same infirmities, not much less voluminous than a special pathological catalogue. As

an inevitable result, a vast number of patients had every reason to repent having tried a mineral course; whilst in the eyes of the profession balneological literature fell into well-merited discredit.

The task of the physician at a watering-place is the very reverse. The medical man abroad who is prevented from making himself acquainted by personal observation with the effects of the individual springs, requires of us a truthful, scientific, and precise definition of the action of the various springs, in order that he may guide his choice by reliable data. In giving these data we indeed reduce very considerably the number of those diseases, for which we are justified in expecting relief; but, on the other hand, we defend the interests of the patient (our sacred duty), and, most assuredly, the real interests of the watering-places themselves. Those whose morbid conditions are similar will be brought together at the appropriate springs, and, departing satisfied with the results of the course, will inevitably diffuse the reputation of the mineral, to which they owe the recovery of their health. It is but a change of public, and, in every respect, a most advantageous change. —

Such are the convictions, upon which the author has acted in the composition of several treatises on the mineral waters of

Schwalbach, and which have guided him also in the present work. May his efforts meet in England with a reception, as favourable as that which they have universally experienced in Germany.

In concluding this historical notice, it may be proper to state that the government of Nassau, particularly under the reigning prince, Adolphus, makes every effort, to promote a branch of industry of such vital importance to the welfare of the land, as the interests of its baths. The success with which these exertions have been attended is sufficiently demonstrated by the fact that, during the summer of 1853, the principal watering-places of Nassau were visited by no less than 40,000 guests; all of whom stayed at least some weeks, while very many prolonged their sojourn to several months <sup>1</sup>).

With reference to the modern requirements of a watering-place, and these are not trifling, Schwalbach

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<sup>1</sup>) Of what great extension the bath-industry of Nassau (if the term be allowed) is susceptible may be inferred from the circumstance, that in its limited area no fewer, than 135 mineral springs rise to the surface. Most of these are totally disregarded; those generally known are Cronthal, Soden, Weilbach, Wiesbaden, Schlangenbad, Schwalbach, Ems, Selters, Fachingen, and Geilnau.

has not remained behind its sister-baths. By the communal authorities, as well as by private individuals, considerable sums are annually expended in various improvements and arrangements, calculated to render the residence of visitors not only profitable in regard to health, but also agreeable in point of comfort and recreation.

It remains only to add, that the public bathing-house has recently been considerably enlarged; that several private bathing-establishments have been formed, as well as additional buildings for the reception of strangers erected. Not only have the immediate environs of the mineral springs been laid out afresh in the newest style, and on a more extensive scale than before, but in all the neighbouring woodlands foot and carriage ways have been made, and suitable spots arranged as resting-places. In 1851 the Weinbrunnen was enclosed anew, and an improved method of filling the stonebottles with the mineral water was adopted. At the present moment a new road to Wiesbaden is being constructed; it avoids the steeper declivities of the Taunus and, winding through the charming scenery of the valley of the Aar, will conduct the traveller by an easy and direct route to the terminus of the Taunus rail-road.



SCHWALBACH  
IN ITS  
PRESENT STATE.

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## A.

# Schwalbach as a Watering-place.

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1. A short account of its situation, salubrity, and amusements, with other details.

### §. 1.

Schwalbach, in contra-distinction to other places of the same name, called also Langenschwalbach, lies under the  $50^{\circ} 8' 30''$  N. latitude, and  $8^{\circ} 11' 6''$  E. longitude from Greenwich. It is situated in the Duchy of Nassau, 25 miles (English) from Frankfort on-the-Maine, 15 from Mentz, 10 from Wiesbaden, 5 from Schlangenbad, 25 from Coblenze, and 15 from Ems. The post-road from Coblenze to Frankfort passes through the town.

Schwalbach lies more than 900 feet above the level of the sea, at the bottom of a circular ravine or caldron, running from S. W. to N. E., and surrounded by lofty mountains which sufficiently shelter it from strong currents of air. There are no standing waters in the environs,

and the mountain brooks in the neighbourhood have all a considerable declination. The nearest large river, the Rhine, is at a distance of seven English miles. On the northern side of the town are several mountains destitute of vegetation, their steepness being too great to allow of cultivation; the rest of the surrounding country consists of wood and arable land. In two directions, a five minutes' walk brings the visitor to the rich and picturesque forests, which stretch up to the very summits of the mountains, and are intersected by roads and innumerable footpaths. The grounds contiguous to the wells are tastefully laid out, and, in the immediate vicinity of the principal lodging-houses, are two avenues, one composed of horn-beam, the other of chestnut trees, both impervious to the rays of the mid-day sun, and offering many an inviting seat for the leisure hours of the stranger. Near the two springs, the waters of which are principally used inwardly, large halls for the drinkers (Trinkhallen) have been erected.

Schwalbach is built rather stragglingly, and is but thinly populated (2200 inhabitants). The hotels and lodging-houses are disposed round

the wells in a large semi-circle, in the centre of which stands the Bathing-house. They are, for the most part, new, have a free prospect both from the front and back, and are amply provided with good-sized, neatly furnished apartments, looking to the South and North.

Due attention is paid to the preparation of the viands, and these may be had either at home or at the tables d'hôte. (At 1 and 4 o'clock.)

The ordinary drinking water is of excellent quality.

There are three churches and one Synagogue in Schwalbach. Two of the churches are devoted to the protestant, and one to the catholic confession. In one of the former, the service of the Church of England is performed every Sunday.

Four physicians attend to the medical treatment. The medicines are prepared by the official apothecary according to the Prussian Pharmacopoeia. A sufficient number of attendants, male and female, is provided for the necessary surgical arrangements.

There is no want of accommodation in the means of conveyance (carriages, horses, asses).

Instruction in the German, French and English languages is to be had.

Those fond of music, will derive enjoyment from the performances of our band, during the season.

In the reading-room will be found the most interesting of the German, and several English and French papers, besides literary periodicals.

The lovers of field-sports have not been forgotten, as the proprietors of the lodging-houses and the hotels have, to please their guests, rented the right of fishing and shooting in the neighbouring streams, and woods.

The interesting points, with which our country abounds, offer the visitor a rich variety of excursions. I mention only Hohenstein and Adolphseck, with their venerable ruins; Hohlenfels with its medieval castle, still in perfect preservation; Schlangenbad, the well-known bathing-place; Selters, with its far-famed spring; the Platte, a hunting seat of the Duke of Nassau; the magnificent Rhinegau, with its vine-clad hills, its smiling towns and villages; and finally the romantic valleys of the Aar and Wisper.

Schwalbach is in daily communication with all the neighbouring towns of any importance, by means of frequent posts.

The average number of guests during the season, including occasional passengers, who make but a short stay, is 5 to 6 thousand.

## §. 2.

The mountains of Schwalbach are a spur of the Taunus, and display a great similarity of form. They belong exclusively to the grey-wacke formation, with predominant grey-wacke-slate, which, running partly into clay-slate, in certain spots, becomes roofing-slate. The slates, often intersected by quartz, not unfrequently assume the form of strongly twisted rolls of quartzous consistency, and inclose pyrites of a regular, cubic form. From the clay-slate proceed the ferruginous springs of Schwalbach. Two leagues to the north of Schwalbach, mining operations were formerly carried on. The ores consisted of potter's ore or lead-glance, cupreous pyrites, carburet of copper, copper-lazuli and Malachite. From the ores still fit for smelting, which are lying about, it appears that the gang was



composed of quartz and florifoliated ponderous spar. During the last six months, diggings for lead-ores have been carried on in the neighbourhood of a village, about a league to the N. W. of Schwalbach. These works promise a favourable result.

The Vegetation round S. is rich and varied; besides red and white beech, oak, birch, fir and larch trees, we find all the shrubs and herbs, which are peculiar to the hill-woods of central Germany. Our immediate vicinity produces kernel and stone fruit of excellent flavour, though in small quantity; there are no grapes. <sup>1)</sup>

### §. 3.

The general state of health in our town is as satisfactory, as can be wished. There are no endemic maladies, either in the town or country. The prevalent forms of illness are catarrhal, rheumatic complaints, which in winter ge-

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<sup>1)</sup> For the professional Botanist I remark that, *Digitalis ochroleuca*, *Arum maculatum*, *Majanthemum bifolium*, *Chrysosplenium alternifolium* and *oppositifolium*, *Ranunculus aconitifolius*, *Lunaria rediviva*, are to be found here.

nerally affect the chest, in summer the abdominal organs. (Summer-diarrhoeas occur here, as everywhere, but not to any extent.) As long as the general character of disease inclined to inflammation, violent pneumonies and pleurisies were observed here; but since the universal predominance of nervous complaints, inflammations have entirely disappeared. But, in this great change, we have been spared by the scourges of our times: the Typhus, and Intermittent.

During my twelve years' residence in this place, in only four villages of our district have insignificant Typhus-epidemics shown themselves; these were proved to have originated in contagion, assumed an extremely mild form, and in a short time ceased entirely. The town remained quite exempt, and the few cases of typhus abdominalis that occurred, were always of sporadic origin. We have no indigenous intermittents, and those persons who come here affected with this complaint, generally recover without the intervention of art. Dysentery is unknown to us, during my practice here I have not met with a single patient of this description. Hooping-cough is not uncommon. Of acute exan-



themata we have, at intervals of several years, the measles among us, mostly on their way from the Rhinegau. An epidemic scarlatina occurred, during twelve years, once in Hohenstein, but not in Schwalbach. Variolae and varioloids have disappeared, since vaccination and re-vaccination have been universally adopted.

Weather and Temperature. — I communicate a report of the meteorological observations of the last four years, as they give a very fair type of the general character. I must only regret, that the currents of air and storms of the year 1844 and partly of 1845 cannot be indicated, on account of imperfect registration.

The state of the Thermometer and Barometer was noted every day, in the winter-months, at 7 a. m., at 2 p. m., and 9 p. m.; during the summer, at 7 a. m., 1 p. m., and at 10 p. m. The thermometer was in the shade, suspended from a tree, in a garden lying to the north, without the town.

The mean Temperature of the months was calculated from the sum of the three daily observations; not from the highest and lowest register of the month.

| Months.     | Height of Thermometer, Fahrenheit. |                                | Height of Barometer              |                                  | Days of Rain. | Days of Snow. | Miscellaneous Observations.                              |
|-------------|------------------------------------|--------------------------------|----------------------------------|----------------------------------|---------------|---------------|--|
|             | Lowest.                            | Highest.                       | Lowest                           | Highest.                         |               |               |  |
| January ..  | + 7                                | + 47                           | 27 <sup>11</sup> 2 <sup>11</sup> | 28 <sup>11</sup> 1 <sup>11</sup> | 10            | 4             | 9 days clear; rest cloudy.                               |
| February .  | + 7                                | + 42 <sup>1</sup> <sub>2</sub> | 26 7                             | 27 10                            | 2             | 9             | 7 days clear; rest cloudy, 3 days tempestuous.           |
| March ....  | + 19                               | + 51                           | 27 1                             | 28                               | 9             | 6             | 4 days clear; rest cloudy, 2 days tempestuous.           |
| April ..... | + 30                               | + 73                           | 27 4                             | 28                               | 0             | —             | 14 days clear; otherwise overcast.                       |
| May .....   | + 39                               | + 74 <sup>1</sup> <sub>2</sub> | 27 3                             | 28                               | 3             | —             | 14 days clear  |
| June .....  | + 46                               | + 88 <sup>1</sup> <sub>2</sub> | 27 1                             | 27 10                            | 2             | —             | 22 days clear.   |
| July .....  | + 48                               | + 77                           | 27 4                             | 27 9                             | 12            | —             | 10 days clear.   |
| August ...  | + 44                               | + 76                           | 27 1 <sup>1</sup> <sub>2</sub>   | 27 10 <sup>1</sup> <sub>2</sub>  | 6             | —             | 14 days clear.   |
| September.  | + 30                               | + 81 <sup>1</sup> <sub>2</sub> | 27 4 <sup>1</sup> <sub>2</sub>   | 28                               | 7             | —             | 14 days clear.   |
| October ... | + 32                               | + 59                           | 27                               | 27 9 <sup>1</sup> <sub>2</sub>   | 9             | —             | 7 days clear, 3 days hoar-frost, 1 day fog.              |
| November .  | + 27 <sup>1</sup> <sub>2</sub>     | + 57                           | 27                               | 28                               | 17            | 6             | 3 days clear, otherwise overcast and changeable, — wind. |
| December .  | + 2 <sup>1</sup> <sub>2</sub>      | + 43                           | 27                               | 27 <sup>1</sup> <sub>2</sub> 28  | 4             | 3             | 5 days clear.  |

1845.

| Month s.        | Height of Thermo-<br>meter, Fahrenheit |          | Height of Barometer |          | Days<br>of<br>Rain. | Days<br>of<br>Snow | Miscellaneous Observations.                                   |
|-----------------|--|----------|---------------------|----------|---------------------|--------------------|---|
|                 | Lowest.                                | Highest. | Lowest.             | Highest. |                     |                    |   |
| January . .     | + 10                                   | + 41     | 26"10"              | 27"11"   | 3                   | 7                  | 7 days fog, 3 days clear.                                     |
| February .      | — 13                                   | + 54     | 27                  | 28       | 0                   | 10                 | 9 days clear, rest cloudy.                                    |
| March . . . .   | — 6                                    | + 50     | 27 3                | 28 4     | 5                   | —                  | 5 days clear, rest overcast.                                  |
| April . . . . . | + 32                                   | + 72     | 27                  | 27 11    | 7                   | —                  | 14 days clear, rest cloudy.                                   |
| May . . . . .   | + 39                                   | + 90     | 27 3                | 27 8     | 15                  | —                  | 2 days clear, rest cloudy.                                    |
| June . . . . .  | + 54                                   | + 88     | 27 4½               | 27 10    | 8                   | —                  | 15 days clear, rest cloudy.                                   |
| July . . . . .  | + 50                                   | + 95     | 27 5                | 27 9½    | 7                   | —                  | 9 days clear, rest cloudy.                                    |
| August . .      | + 45½                                  | + 76     | 27 3                | 27 11    | 10                  | —                  | 2 days N. 2 E., rest W. and S. W.                             |
| September       | + 36½                                  | + 77     | 27 4½               | 27 9     | 7                   | —                  | 4 days hoar-frost, 1 storm, 5 N. 2 E. 1 ESE., rest W. and SW. |
| October . .     | + 32                                   | + 70     | 27 3                | 28 1     | 10                  | —                  | 4 days hoar-frost, 1 fog, 4 N. 2 NW. 7 W., rest always SW.    |
| November .      | + 27½                                  | + 42     | 27 3½               | 27 9½    | 9                   | —                  | 1 E. — 1 S. — 4 W. — rest always WSW.                         |
| December .      | + 16½                                  | + 37     | 26 6                | 27 10½   | 17                  | 7                  | 2 days N. 3 NW., rest W. and SW.                              |

| Months.        | Height of Thermo-<br>meter. Fahrenheit. |                    | Height of Barometer     |                     | Days<br>of<br>Rain. | Days<br>of<br>Snow. | Miscellaneous Observations.  |
|----------------|---|--------------------|-------------------------|---------------------|---------------------|---------------------|--|
|                | Lowest.                                 | Highest.           | Lowest.                 | Highest.            |                     |                     |  |
| January . .    | + 8                                     | + 53 $\frac{1}{2}$ | 27 $''$                 | 28 $''$ 3 $'''$     | 13                  | 3                   | 2 days fog, 5 clear, WSW prevalent, 1 N. 3 NW.   |
| February .     | + 12                                    | + 61 $\frac{1}{2}$ | 27 $''$ 3 $\frac{1}{2}$ | 27 11               | 12                  | 5                   | WSW. 3 N. — 4 days clear, rest cloudy.   |
| March . . .    | + 25                                    | + 65               | 27 2                    | 28 1                | 15                  | 3                   | 5 days hoar-frost, $\frac{2}{3}$ SSW., and SW., $\frac{1}{3}$ WSW.                                   |
| April . . . .  | + 34                                    | + 69 $\frac{1}{2}$ | 26 11                   | 27 10               | 14                  | 1                   | 3 days hoar-frost, $\frac{2}{3}$ W. and S. $\frac{1}{3}$ N, NW., 4 days clear.                       |
| May . . . . .  | + 38 $\frac{1}{2}$                      | + 76 $\frac{1}{2}$ | 27 2 $\frac{1}{4}$      | 27 11               | 6                   | —                   | 2 days hoar-frost, $\frac{3}{4}$ SW. and WSW; $\frac{1}{3}$ N. and NW.;<br>1 thunder-clouds.         |
| June . . . . . | + 54 $\frac{1}{2}$                      | + 84               | 27 4                    | 27 11 $\frac{3}{4}$ | 7                   | —                   | $\frac{2}{3}$ N. and NW.; $\frac{1}{3}$ S and SW. — 15 days quite clear,<br>$\frac{3}{4}$ 1 thunder. |
| July . . . . . | + 58 $\frac{1}{2}$                      | + 88 $\frac{1}{2}$ | 27 4                    | 27 11               | 8                   | —                   | S. SW. and SSW., 1 day stormy; 29th. at 9 h.<br>35 m. p. m. earthquake.                              |
| August . . .   | + 54 $\frac{1}{2}$                      | + 90               | 27 5                    | 27 10               | 9                   | —                   | 3 days fog, $\frac{2}{3}$ S. and W., $\frac{1}{3}$ N., 1 thunder-storm.                              |
| September.     | + 36                                    | + 81 $\frac{1}{2}$ | 27 3                    | 27 10               | 9                   | —                   | 1 day fog, 3 N. 2 E., rest W. and SW.  |
| October . . .  | + 30                                    | + 65               | 27 1 $\frac{3}{4}$      | 27 9                | 15                  | —                   | 6 days W. 2 S., rest SW. and WSW. 6 days fog.  |
| November.      | + 24 $\frac{1}{2}$                      | + 54 $\frac{1}{2}$ | 27 1                    | 28                  | 7                   | —                   | 9 days SW., 7 W., 7 WSW., 4 N., rest NW.   |
| December .     | — 6                                     | + 38 $\frac{1}{2}$ | 26 7                    | 28 1                | 3                   | 14                  | $\frac{3}{4}$ W. and SW., $\frac{1}{4}$ N.   |

| Months.      | Height of Thermometer, Fahrenheit. |                    | Height of Barometer            |                     | Days of Rain. | Days of Snow. | Miscellaneous Observations.   |
|--------------|------------------------------------|--------------------|--------------------------------|---------------------|---------------|---------------|---|
|              | Lowest.                            | Highest.           | Lowest.                        | Highest.            |               |               |   |
| January . .  | + 12                               | + 42 $\frac{1}{2}$ | 27 <sup>u</sup> 1 <sup>m</sup> | 28 <sup>u</sup>     | 6             | 8             | 22 days W., 2 E., rest SW.  |
| February .   | - 2                                | + 49               | 26 9                           | 27 11               | 10            | 3             | $\frac{1}{4}$ E., 3 N., 14 W., rest SW.<br>1 day fog, 5 hoar-frost, 9 NE., 7 W., rest SW<br>28 th. thunder and storm. |
| March . . .  | + 3                                | + 61               | 27 1                           | 28                  | 4             | 7             | 1 day fog, 1 hoar-frost, 15 W., 3 N., 4 NE.,<br>2 stormy, rest variable.  |
| April. . . . | + 30                               | + 59               | 26 10                          | 27 7                | 13            | 6             | 1 day fog, 18 W., rest SW., 3 thunder-storm.  |
| May . . . .  | + 39                               | + 88               | 27 4                           | 28                  | 13            | —             | $\frac{3}{4}$ SW., $\frac{1}{4}$ NE. W. and NW., 2 hazy, 2 thunder-storm  |
| June . . . . | + 46                               | + 77               | 27 4                           | 27 11               | 18            | —             | 13 W., 5 NE., 3 NW., rest variable, 3 thunder-storm.  |
| July . . . . | + 52                               | + 92 $\frac{1}{2}$ | 27 5 $\frac{1}{2}$             | 27 11               | 10            | —             | 1 day fog, $\frac{5}{8}$ SW., $\frac{1}{8}$ NE., 2 thunder-storm.   |
| August . . . | + 47                               | + 86               | 27 3 $\frac{3}{4}$             | 27 10 $\frac{3}{4}$ | 13            | —             | 2 days fog, $\frac{2}{3}$ W., $\frac{1}{3}$ SW., and NE.  |
| September.   | + 38 $\frac{1}{2}$                 | + 72               | 27 2                           | 27 10 $\frac{3}{4}$ | 13            | —             | 7 days fog, 2 hr-frost, $\frac{2}{3}$ SW $\frac{1}{3}$ NE., 1 thunder-storm.  |
| October . .  | + 30                               | + 65 $\frac{1}{2}$ | 27 2 $\frac{3}{4}$             | 28                  | 11            | —             | 11 days fog, 6 hoar-frost. $\frac{1}{4}$ E., $\frac{3}{4}$ SW.  |
| November     | + 21                               | + 54               | 27 5                           | 28                  | 9             | 1             | 8 days fog; 8 hoar-frost, 17 SW., 2 W., 5 NE.,<br>2 E., rest variable.  |
| December .   | + 14                               | + 48               | 27 1                           | 27 8 $\frac{1}{2}$  | 5             | 2             |   |



The greatest cold (— 13°F.) occurred on the 12<sup>th</sup> February 1845. at 7 a. m. with a clear sky and the Barometer at 27" 10""; the greatest heat (+ 95 F.) was on the 8<sup>th</sup> July 1845, with clear sky and Barometer at 27" 9"". <sup>1)</sup>

The mean Temperature of April =  $48\frac{8}{10}$  F., of May =  $56\frac{7}{10}$  F., of June =  $65\frac{9}{10}$  F., of September =  $56\frac{9}{10}$  F., of October =  $48\frac{3}{10}$  F.

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<sup>1)</sup> On comparing the lowest height of the thermometer in Schwalbach with that of Wiesbaden, lying 586 Paris feet lower, an average of 12 months gives for Schw. a minus of  $6 - 6\frac{1}{2}$  ° F. This difference is principally attributable to the greater severity of the winter-months in Schwalbach. For the months May, June, July, August and September, the proportion is otherwise. From the sums of the lowest height of the thermometer during these 5 months, taking a mean of 4 years, the difference between Schwalbach and Wiesbaden appears = 4 ° F.

This is a circumstance very advantageous to us during the season. Whilst in the neighbouring places, which are situated at a lower level, the heat is highly oppressive, we breathe here the pure mountain air. And even if, in the meridian hours, the sun sometimes makes himself felt, yet the evenings invariably bring with them a refreshing coolness.



The Barometer was seldom below 27'' and that only 2 days in February 1844, 2 days in January 1845, 4 days in December 1845, 3 days in April 1846, 3 days in December, 1 day in February 1847 (on the 9<sup>th</sup> at 7 a. m.) and 1 day in April 1847 (on the 2<sup>nd</sup> at 9 p. m.).

The greatest height of the Barometer (28'' 3''') was observed at 9 p. m. on the 9<sup>th</sup> January 1846, with + 34° F., and sky overcast; during the morning and noon of the same day there had been fog. -- Most of the rainy days were in November 1844, and December 1845 (17 in number). There was rain in every month of the above-named years, with the exception of February 1845.

Most of the snow-days occurred in December 1846 (14 in number).

The extreme term of snow is generally confined to March; but in 1847 we had 6 days of snow in April, and in 1846 one in the same month. The first winter-snow appeared 24<sup>th</sup> November 1844, and 17<sup>th</sup> November 1847.

The prevailing Winds are West and South-west, in all years and seasons.

Of fog we find 1 day in October 1844, 7 in January 1845, 2 in January, 3 in August, 1 in September, and 6 in October 1846; 1 in March, 1 in April, 1 in May, 1 in August, 2 in September, 7 in October, 11 in November, and 8 in December 1847. — Hoar-frost is noted 3 days in October 1844, 4 in September, and 4 in October 1845, 5 in March, 3 in April, 2 in May 1846; 5 in March, 1 in April, 2 in October, 6 in November, and 8 in December 1847.

Thunder-storms:

1845. 1 on 18<sup>th</sup> September. Therm. + 72° F.

Bar. 27" 5"', Wind SW.

1846. Thunder-clouds on 5<sup>th</sup> May, at 2 p. m.;

Therm. = + 74; Bar. = 27" 5"', 8;

WSW. Storm 17<sup>th</sup> August, noon, W.

1847. Storm on 28<sup>th</sup> March 9 p. m. with wind

and rain; Therm. = + 48°; Bar. = 27"

4''; SW. 3 storms in May:

a) on the evening of the 11<sup>th</sup> with rain, at + 62°. Bar. 27" 5''' 3. SW.

b) on 14<sup>th</sup>, noon, at + 70° and 27" 8''; SW;

c) on 29<sup>th</sup> towards evening, at + 72° and 27" 9''; SW.

2 Storms in August:

- a) on 19<sup>th</sup>, afternoon, with a little rain;  
Therm. + 76°; Bar. 27'' 9''' 3; S.;
- b) on 20<sup>th</sup> at 5 1/2 p. m. with hard rain;  
Therm. + 68°; Bar. 27'' 7'''; SSW.

1 Storm in October:

on the 18<sup>th</sup>, at 3 1/2 p. m.

Therm. + 67°; Bar. = 27'' 7''', 7; SW.  
with little rain.

Earthquake. On the 29<sup>th</sup> of July 1846 at 9 h. 35 m. p. m., the earthquake was observed here, which, at the same time, was felt in south-eastern Belgium, the greater part of the Prussian Rhine-land, the Prussian districts of Munster and Arnsberg, in the principality of Waldeck, the southern part of Hanover, the Saxon Duchies, Electoral Hessen, the north of Bavaria and Wurtemberg, almost throughout Baden, in the grand-duchy of Hessen, in the territory of the City of Frankfort, in all Nassau, Rhenish Bavaria, Rhenish Hessen, and in the northwestern part of France.

The sky was clear and starlight; the barometer at 27'' 9''', 5; the thermometer at 65°F. In the morning the wind came from the NW;

at mid-day from the East; the same in the evening and on the following day. The shock, which appeared to run from SE. to NW., lasted several seconds.

The concussion was felt principally in the upper stories, and was by all observers compared to the rolling of a heavy waggon over a paved road. Doors sprang open, windows clattered, glasses jingled against each other, pictures and objects hanging against the wall began to oscillate; it is even said, that at Schlangenbad horses were thrown down in the stables. About a minute before the shock, I saw a dog run about the room with every appearance of terror. Fissures were produced even in the walls of houses built of stone. The shock was not repeated. On our mineral-springs the phaenomenon had not the slightest influence. Persons, accidentally employed in drawing water from the so-called „Weinbrunnen“ or spring, assert, that no movement was perceptible in the water, neither was any change observed subsequently.

Not only amongst our bath-visitors, but also among the inhabitants of Schwalbach this phaenomenon created the utmost consternation, earth-

quakes being here quite unknown. Several nervous females fell into convulsions.

## II. The Mineral-springs <sup>1)</sup>.

### §. 4.

I shall here give an account only of the four principal wells: the Weinbrunnen, the Paulinenbrunnen, the Stahlbrunnen and Rosenbrunnen.

The Weinbrunnen, the oldest of the Schwalbach springs, known to the Romans by the name of *Aqua vinaria Usipetum*, and brought into vogue in 1581 by *Tabernaemontanus*, is situated about 30 paces from the bathing-house, in a pleasant little valley near the high-road to Wiesbaden.

In the same valley, a few hundred yards above the Weinbrunnen, lie the Pauline and Rosen wells, both set in one inclosure, — discovered in 1828.

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<sup>1)</sup> The immediate vicinity of Schwalbach is very rich in mineral-springs. Almost all the villages on the North and West sides of the town possess some: for instance, Adolphseck, Nastätten, Springen, Dickschied, Gladbach, Ramschied, Fischbach. They are all weak chalybeates.



The Stahlbrunnen, discovered in 1740, and recommended by Schweizer 1770, is situated in another valley to the north-west of the one just mentioned, and separated from it by the ridge of a hill; the distance from the bathing-house is a few hundred paces <sup>1)</sup>).

The water of all the four wells has a pale blue speculum, is of yellow transparency, smells of carbonic acid, and has an inky, but very refreshing taste. It pearls or bubbles strongly, and at the bottom of the wells, as also in the conducting pipes and reservoirs an ochre-coloured sediment is deposited. The temperature of the Weinbrunnen is 49° F., that of the Stahlbrunnen 50°, of the Paulinenbrunnen 48°, and of the Rosenbrunnen 49°; the transparency of the second 0,925; that of the Pauline well 0,945. The escape of carbonic acid gas proceeds most slowly in the water of the Weinbrunnen.

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<sup>1)</sup> Besides these the precincts of the town include the „Ehebrunnen, Lindenbrunnen, Brodelbrunnen, Neubrunnen, Kochbrunnen, and Stockbrunnen.“



# **Chymical Analysis according to Karstner:**

A pound of water, of 16 ounces, contains:

|   | Weinbr.    | Stablbr.    | Paulbr.    | Rosenbr. |
|---|------------|-------------|------------|----------|
| Carb. Acid Gas  | 26 cub.In. | 28, 1 c. I. | 39,8 c. I. | 26 c. I. |
| Residuum siccum<br>of 16 ounces.  | 5,8 grain. | 3,39 gr.    | 5,84 gr.   | 5,1 gr.  |
| Carbonate of Iron   | 0,835      | 0,75        | 0,65       | 0,91     |
| C. of Soda . . .  | 0,175      | 0,25        | 0,4500     | 0,3500   |
| C. of Manganese   | 0,00015    | 0,00017     | 0,002      | 0,0002   |
| C. of Lime . . .  | 2,110      | 1,4         | 2,9550     | 2,95     |
| C. of Magnesia  | 3,125      | 0,88        | 2,7500     | 0,98     |
| Muriate of Soda   | 0,185      | 0,34        | 0,0300     | 0,32     |
| „ of Potash   | 0,00025    | 0,0013      | 0,0012     | 0,0003   |
| Sulphate of Soda  | 0,160      | 0,21        | 0,0250     | 0,0075   |
| Phosphate of Soda   | 0,00015    | 0,00017     | 0,0015     | 0,0002   |
| Silicate acid . .   | 0,00015    | 0,00020     | 0,0003     | 0,0003   |
| Alumina . . . .   | 0,0001     | 0,00005     | 0,0002     | 0,0002   |
| Strontia, Hydro-<br>jodate of Potash,<br>Lithia and organic<br>substances, traces<br>estimated at . . . | 0,0002     | 0,00011     | 0,0008     | 0,0002   |
|   | 6,59100    | 3,83200     | 6,8660     | 5,5189   |

The three first springs are used as well for drinking as bathing. The Rosenbrunnen is only used for baths, when mixed with the Paulinenbrunnen.

### III. The Baths.

#### §. 5.

The Bathing-house is situated in the centre of the semicircle formed by the houses destined to the reception of the bath-visitors. It belongs to the Ducal domains, and is but at a very trifling distance from the Hotels and lodging-houses; a good road leads up to it. The Bathing-house, a tasteful erection of 1828, is above 200 feet in length; on the ground-floor, to the left, we find the baths of the Weinbrunnen, on the first floor, on the same side, those of the Paulinen and Rosenbrunnen; to the right-hand, in both stories, the baths of the Stahlbrunnen. The bath-closets, 47 in number, are roomy, well ventilated, and in every respect appropriately furnished. Opposite these closets, in the upper floor, is a handsome saloon, serving in unfavourable weather as a place of resort previous to, and after, bathing.

The water of these four springs runs through well-closed iron pipes into three separate reservoirs, accumulates here during the afternoon

and night, and is drawn off direct into the bathing-tubs.

At an earlier period, it was warmed by mixture with hot water; now, however, this has for some years been effected by steam, which is prepared in three boilers, placed in an adjacent building.

Each bath has a double bottom, the upper one is of metal, the lower of wood; between the two is an interval of about six inches, and into this, as soon as the cold water is turned on into the bathing-tub, the steam is conducted, and by heating the above-mentioned metal bottom produces the desired temperature. Fourteen cubic feet of mineral-water (the usual quantum for a bath) are, in this manner, heated, to 90—94½ F. in the course of 4—10 minutes. By this arrangement, the escape of carbonic Acid, which on heating the water cannot be avoided, is reduced to the smallest possible minimum.

The Douche-baths are given by means of forcing-pumps.

The towels and necessary linen can be had warm, if required; drying-baskets with chafing-dishes are not used here.

For the conveyance of patients, or in case of bad weather a number of sedan-chairs are in readiness.

The attendants are all well acquainted with their duties.

There are two other bathing establishments, small indeed, but very well arranged. They are in the „Russian Hotel“ and in the „Stadt Coblenz“, and the baths are warmed by the process described above. The water is carried to these hotels in well-closed casks, and suffers, therefore, no decomposition.

All the inhabitants of Schwalbach have the right of giving mineral-baths in their houses. In the preparation of the bath cold mineral-water is mixed with warm. There is every prospect of the speedy establishment of gas-baths.

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## **B.**

### **Effect of the Schwalbach Mineral-water when taken methodically at the springs.**

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This head may be subdivided into the effect of the mineral-water, and the effect of local and dietetic influences.

#### **I. Effect of the Mineral-water.**

In order to obtain a more accurate insight into the effects of our chalybeate water, it will be advisable to consider the pharmacodynamic importance of its most essential elements (iron, carbonic acid gas, and water), and to investigate the reciprocal relations of the same.

We have consequently to direct our attention to,

##### **1. The effect of the Iron.**

##### **§. 6.**

In order that proper light may be thrown upon the effect of iron, I shall take the liberty



of reporting the appearances produced in a healthy organism, by its internal application.

For this purpose I shall avail myself of the valuable labours of F. Loeffler: „Materials for Pharmacology“ (Materialien zur Arzneimittellehre), collected by him in the „Zeitschrift für Erfahrungsheilkunst“ (Journal of Empirical Therapeutics), and shall communicate, almost verbatim, his observations on Theodore Petruschky, the most susceptible of all those individuals, who have been subjected to experiments with iron.

The preparation of iron selected for these experiments was Liquor Acetatis Ferri having a specific gravity of 1,140—1,145, and containing 8 p. c. of iron, or 11,43 of oxyde of iron. The medicament was administered by drops, in water. The contents of a common phial, holding one ounce of the liquor, gave 720 drops for 1 oz., and 90 drops for a drachm.

Theod. Petruschky, aged 21 years, short in stature, but of an uncommonly robust frame, complexion florid, — never had any illness of consequence since his 6<sup>th</sup> year. In 15 days, from the 12<sup>th</sup> to the 26<sup>th</sup> of July, he took  $6\frac{2}{3}$



drachms of the liq. ferr. acet., commencing with 4 drops 4 times a day, and increasing to 24 drops pro dosi. The examination of the blood taken from him on the 9<sup>th</sup> and 24<sup>th</sup> of July, produced the following result:

1000 of Blood gave:

| Before the use of Iron: |   | After ditto |       |
|-------------------------|---|-------------|-------|
| Serum . . . . .         | 465,2                                   | . . . . .   | 427,8 |
| Resid. sic. . . . .     | 57,9                                    | . . . . .   | 37,9  |
| Ash . . . . .           | 9,2                                     | . . . . .   | 8,6   |
| Placenta (crassamentum) | 498,0                                   | . . . . .   | 552,5 |
| Resid. sic. . . . .     | 167,7                                   | . . . . .   | 184,1 |
| Ash . . . . .           | 24,9                                    | . . . . .   | 34,5  |
| Red Sediment . . . . .  | 36,8                                    | . . . . .   | 19,7  |
| Fibrine . . . . .       | 2,13                                    | . . . . .   | 2,17  |
| Water . . . . .         | 758,4                                   | . . . . .   | 789,6 |
| Resid. sic. . . . .     | 239,5                                   | . . . . .   | 208,3 |
| Fat . . . . .           | 4,02                                    | . . . . .   | 1,76  |
| In 100 of Ash           | { Salts soluble in water. 8,1 . . . . . |             | 9,1   |
|                         | { Oxyde of Iron . . . . .               |             | 0,9   |
|                         | { Phosphate of Lime with                |             |       |
|                         | { other earthy matters . 0,4 . . . . .  |             | 0,6   |

Previous to the use of Iron the blood was of a clear red, exhibited few and small colourless globules, but an extraordinary quantity of elementary corpuscula; the first portion drawn, coagulated in 5' 45"; the serum was of a light yellow, clear, alkaline, the placenta firm and elastic.

Subsequently to the use of Iron, the blood presented a dark red appearance, the red globules were intensely coloured and with very sharp outlines; there were many large, white globules; of elementary corpuscula scarcely any were to be perceived. The blood coagulated in 8' 54"; serum clear, alkaline, dark yellow, placenta compact and elastic.

In the first days of the experiment, immediately after having taken the medicine (4 drops), Petruschky had a sensation of warmth and fullness in the region of the stomach.

After the second dose of the 13<sup>th</sup> (at 10 a. m.), after the use of 20 drops, he perceived a sensation of heaviness in the head, and felt a tension of the forehead with pressure in both temples.

After the dose taken at 2 p. m. these sensations became more intense, and were accom-

panied by a feeling of exuberant fulness in the head.

A recumbent posture mitigated in some measure the pressure of the temples; cool air, or touching the forehead with a cold substance produced no change whatever. At bed-time, these symptoms were present, in all their intensity.

14<sup>th</sup> July. P. slept well during the night, — on awaking, felt his head relieved, especially the forehead was more free, whilst, in the temples, the sense of pressure continued. At 6 a. m. he took 4 drops; the fulness in the head immediately increased.

„All surrounding objects,“ such are the words of the protocol, „appear to me larger and more elevated than usual; I am inclined to attach much importance to trifles, and am in bad spirits, though there is no cause for it.“

On that day no more medicine was taken. After half an hour's sleep in the afternoon, the affection of the head abated, leaving only the sensation of fulness. Having taken a walk in the evening, he felt himself, notwithstanding a certain tension of the head, „strong and hearty.“

15<sup>th</sup>. The night's rest has driven away the affections of the head, excepting only a trifling oppression; and although 4 drops were administered 4 times in the course of the day, his health was not altered.

16<sup>th</sup>. (6 dr. 4 times, at 6, 10, 2, and 6 o'clock.) Felt himself perfectly well till 8 a. m. From that hour the sense of weight and repletion in the head augmented; each pulsation was felt in the temples. To this was added an itching in the urethra, especially in the Fossa navicularis, in the afternoon united with a desire of voiding urine. „Otherwise I feel myself in excellent health, and even more vigorous than usual“. Voracious appetite.

17<sup>th</sup>. (6 dr. 4 times.) The nocturnal repose had been troubled by wild dreaming of a distressing kind; in the morning the head was somewhat relieved, but the general sense of vigor heightened. This feeling, concomitantly with a voracious appetite, rose in the course of the day to a propensity for destruction, although the heaviness of the head also began to return, although the urinary impulse, together with an

itching in the urethra extending up to the neck of the bladder, continued, and, towards the middle of the day, even a slight oppression of the chest supervened. During a foot-bath taken in the evening the sense of fullness in the head disappeared, but returned, after the bath, with redoubled violence.

18<sup>th</sup>. (8 dr. 4 times.) Passed the night well; a pressure in the head was still felt, but it did not grow stronger in the course of the day. The desire to void urine continued, whilst the itching in the urethra had almost entirely ceased. The affection of the chest, however, became more severe. A sense of compression about the whole chest; a necessity for making deep inspirations; slight shooting pains in the lungs; tension in the region of the heart. Percussion and auscultation do not announce anything abnormal; pulse 61 — hard.

19<sup>th</sup>. (10 dr. 4 times.) In the same state as yesterday; it is to be remarked, that to-day the sensation of warmth in the stomach, immediately after exhibition, was repeated.

20<sup>th</sup>. (12 dr. 2 times.) The enhanced feeling of energy, very perceptible yesterday, was on



awaking this morning, no longer felt; it gave way gradually to a sense of relaxation in the limbs. In the head the pulsations were again palpable and accompanied by slight shooting pains. The appetite was still good, but every time after taking food, even in a small quantity, cardialgia took place, of which P. previously never had to complain, even after the most immoderate indulgence.

21<sup>st</sup>. (14 dr. 4 times.) Sleep—good; on rising, the head tolerably free; a healthy feeling with the exception of a certain exhaustion, which, in the course of the day, augmented. The urinary inclination continued. After every dose of the medicine, a sensation of warmth and fulness in the stomach; cardialgy every time after eating.

22<sup>nd</sup>. (16 dr. 4 times.) Head and chest quite free. The desire to void urine continued. Though the tongue was clean, — little appetite; cardialgy after eating and after taking the medicine, together with a continuous sensation of warmth about the stomach, which, however, bore a tolerably strong pressure of the hand without pain. The rud-



diness and fulness of the face diminished visibly. (Pulse 55, not large, but full and tense.)

23<sup>rd</sup>. (18 dr. 4 times.) In conjunction with the lassitude in the limbs, the affection of the stomach begins to be more distinct, exhibiting the same symptoms as before, but amounting, though only for a time, to a disagreeable contraction about the region of the stomach, especially after dinner (consisting of French beans with a little vinegar). No motion.

24<sup>th</sup>. (20 dr. 4 times.) Appetite greatly diminished, and tongue strongly furred with yellowish grey; head oppressed, confused; feeling of lassitude and heaviness in the limbs; no motion.

25<sup>th</sup>. (22 dr. 4 times.) The same appearances in an increased ratio.

26<sup>th</sup>. (24 dr. twice.) Pulse 54, small, tense. On awaking in the morning a painful, irritating sensation in the larynx, forcing him to cough and clear his throat, and aggravated by pressure of the part; towards noon, however, this symptom disappeared, and gave way to a similar feeling behind the upper third of the

sternum. On coughing and clearing the throat a vesicular, viscid mucus, saturated with dark blood was discharged; this occurred repeatedly till 4 in the afternoon. With the exception of a certain Rhonchus mucosus behind the manubrium sterni and a throbbing pulsation of the heart, auscultation showed no irregularity. The head always was in a confused state. The diminution of the feeling of vigor was distinctly visible in the features and general deportment. Blood drawn at 6 p. m. (Vide table.)

27<sup>th</sup>. Pulse 60, somewhat larger, but still tense. Except a tickling sensation in the trachea, particularly on inspiration, and which often excites coughing, the chest is free. The ideas are still confused; P. feels himself mentally and bodily much depressed. Tongue foul, taste doughy, little appetite, thirst not increased. A hard stool. Towards evening contractive paroxysms throughout the abdomen.

28<sup>th</sup>. The air-passages quite free; the other appearances the same as yesterday, only the griping pains were more severe, lasted the whole day. Stool — soft.

29<sup>th</sup>. Pulse 67 — still tense. On rising profuse bleeding at the nose, by which the head was much relieved. Copious, slimy sediment in the urine. General lassitude, the griping pain moderate, but continuous. A hard stool.

30<sup>th</sup>. Pulse 68 — less tense; the pain in the abdomen had almost passed off; head nearly free, lassitude and heaviness in the limbs continue. Stool — copious and soft.

31<sup>st</sup>. Decrease of the feeling of lassitude. Increase of appetite; the tongue, however, is not yet clean.

August 1<sup>st</sup>. Pulse 70 — moderately large and soft; felt quite well, and remained so.

Aug<sup>st</sup>. 2<sup>nd</sup>. Pulse 75 — normal, as before the exhibition of the medicine.

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## §. 7.

In this trial, the effects of Iron are most strikingly exhibited.

Locally applied the remedy is astringent; when taken inwardly it acts as a tonic and astringent.

a) As belonging to the local, astringent effect, is to be reckoned the elevation of tone in the mucous and musculous membranes of the intestines, immediately consequent on internal exhibition. Quickened peristaltic motion, increase of appetite, improvement of the processes of Chymification and Chylification, promotion of the resorptive activity of the tractus intestinalis, limitation of the secretions on the pituitous tunic, and thence costiveness, are what we generally observe after a few days, if the dose has been properly chosen. In the case of a young lady, aged 19, of a delicate frame, who was suffering from a diarrhoea, which produced 8—10 watery stools daily, and, during four months, had resisted all the efforts of medicine, I witnessed, that, from the third day of the exhibition of our mineral water, the evacuations were less frequent and of greater consistency, and after two weeks' application became perfectly normal. In the experiment of Loeffler referred to above, no delay was experienced in the stools, till the 13<sup>th</sup> (a circumstance easily explained by the smallness of the dose), and they came afterwards more rarely, once, after a

pause of three days. The faeces were of an elongated form, and the longer, the firmer. Already on the third day of using the iron they appeared of a greenish colour, became then dark-green, and at last quite black. This is a well-known appearance, ascribed, by Barruel, to the formation of tannin and gallic acid, said to be contained in the aliments; by Trousseau, to a change in the bile; by Bonnet, to the formation of sulphurate of iron. Bonnet's supposition seems to be correct, for both smell and taste of the eructations speak in its favour, and the blackening of the teeth, after the use of resolved salts of iron, is probably owing to the fact, that the sulphur of the saliva and sulphuretted hydrogen-gas rising from the stomach combine with the iron, left on the teeth.

The astringent effect of iron, topically applied, is, on taking mineral-baths, moreover visible in the increased contraction of the skin, and in the diminution of profuse perspiration arising from weakness, as also in the speedy decrease of profuse mucous discharges from the genitals after injections.



b) Of much greater importance than the local effect of iron, is the general. It has been long recognised as tonic, and astringent.

Let us now ask: „How does iron produce this effect?“

This question leads us back to the physiological importance of iron, in the animal system.

The haematine of the blood-globules is known to be a combination of iron, and Liebig's careful investigations have proved, that in no other part of the body is iron to be met with.

Now the combinations of iron, as protoxydes, possess the faculty of withdrawing oxygen from other combinations of oxygen; while in the state of oxydes they are apt to lose a great part of their oxygen.

Ex. gr. Carbonate of iron (a protoxyde), in contact with water and oxygen, is decomposed; all the carbonic acid contained in it, escapes; by receiving oxygen it is transformed into hydro-oxyde of iron.

The protoxyde of iron has, moreover, a strong propensity to form a union with carbonic acid.



The red globules of the arterial blood contain a combination of iron, saturated with oxygen (oxyde), which, during its progress through the larger and smaller vessels undergoes no change, (at least, being in a state of perfect oxydation, cannot receive any more oxygen,) but in the capillary system loses its oxygen and becomes a protoxyde.

One portion of this liberated oxygen serves to produce the interchange of the substances, and determines the succession of animated parts, as well as the formation and generation of the secretions. Another, and greater, portion is applied to the transformation of those substances no more belonging to the animated parts, into combinations of oxygen. (Liebig.) One of the products of this process of oxydation is Carbonic Acid.

This carbonic acid unites with the iron-protoxyde of the globules of blood; and the latter, having passed through the capillary system, absorb the carbonic acid on their way through the veins to the lungs.

In the lungs they eject the carbonic acid

by expiration, and, in its stead, combine with the oxygen of the air, and return as oxyde to the arteries.

The totally exhausted carbon of the body is, however, removed not by means of the lungs alone, but also, in part, by the skin. There the process we have just observed in the lungs, is repeated: the oxygen of the red globules of the blood acts also here, as the intermediary.

I said just now, the totally consumed carbon, because a great part of it, not yet destined to excretion (namely that, which by the interchange of the textures had not yet combined with the oxygen) either passes through the liver and in the gall is reconducted to the blood, or deposits itself, in the shape of fat, in the cellular tissue.

A second product of oxydation, formed by the expulsion of consumed animal parts, is water.

To this, the remarks I made on the carbonic acid, are equally applicable.

By the combination of the Carbon and Hydrogen of the textures with the inhaled Oxygen, by this elementary

analysis (Combustion) animal warmth is generated.

Thirdly and finally the oxygen combines with the exhausted nitrogen, and effects its removal by the urine. (Uric acid.)

Here we see the great importance of Oxygen. The processes of alimentation, of secretion, of excretion, and the production of animal warmth are its work, in a word, — the whole principle of life.

As a light, though abundantly fed with oil, burns less brilliantly, if its supply of oxygen be diminished, and on total deprivation, is instantly extinguished, so does the animal system sicken on imperfect or insufficient oxydation of the blood, and on its cessation immediately perish (sudden death in irrespirable gases, even if they contain no directly pernicious constituents). — The oxygen is, as we have seen, attached to the iron of the red globules of the blood. It is in the arterial blood that the iron is found in the highest degree of oxydation. The quantity of oxygen in the blood must, therefore, be in proportion to the quantity of iron. If the latter mount above the normal

state, we shall have the appearances of hyper-oxydation of the blood (Congestions, nervous symptoms, etc.); if it fall below this standard, the consequences of imperfect oxydation must necessarily manifest themselves <sup>1</sup>).

### §. 8.

Let us now imagine a morbid condition, occasioned by a deficiency of iron in the blood, and observe, what changes are brought about by the exhibition of the metal.

According to Bouisson the ferruginous Hæmatine is to be found already in the Chyle, and proceeds from the alimentary substances. In the absorbent vessels of the intestinal canal, it forms a part of the lymphatic globules.

If, therefore, we administer iron in such a form, and in sufficient doses, to allow of its

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<sup>1</sup>) For our purpose it is indifferent, whether all the oxygen, that is conducted to the body, has been absorbed by the iron in the globules of blood, or whether, in this operation, also the fibrine is to be considered as an active medium. (Scherer.) This much is certain, that the iron is the vehicle of by far the greater quantity. (Budge.)

being absorbed. the first consequence will be, that the Chyle in the absorbents of the intestinal tract becomes more ferruginous.

This extra-ferruginous Chyle mixes with the venous blood, and is transferred to the lungs. Here it absorbs oxygen. It has just been proved that the quantities of oxygen, and of iron in the blood stand in exact proportion to each other.

Consequently, more oxygen is now received into the lungs, than was the case before the use of iron: the arterial blood is richer in oxygen.

What must now take place?

The increased quantity of oxygen, having arrived in the capillary system, will occasion a greater interchange of the organic tissues: of the Proteine contained in the blood, a larger portion is applied to new formations; of that which is exhausted, the separation is augmented.

If we now suppose, that the supply from the aliments were to remain the same as before the use of the iron, not only the blood would, if the exhibition of the metal were persevered in, become gradually poorer in nitrogenic, carbonic, and hydrogenic elements, but also the substances of the organs, fat, muscles,



nerves, and brain would be consumed, and death in a short time ensue. The real cause of death, in this hypothetical case, would be the respiratory process, the influences of the atmosphere. The flame expires, because the oil is spent: it is the oxygen of the air that has consumed it.

In order to avoid the lethal catastrophe, and — to go still farther, — in order to restore the quality of the blood to a normal condition, a more abundant supply of nutriment, both of plastic and respiratory substances (:Liebig:) will be necessary.

In this point, we are powerfully assisted by nature. The patient's appetite improves generally in an extraordinary degree, and he digests his food more completely and with greater facility.

In Loeffler's experiment „an extraordinary appetite“ manifested itself on the 6<sup>th</sup> day, and the patient became quite voracious the following day.

By the improvement of the appetite and the more regular function of the intestinal canal, both the chyle and the blood become richer in solids, in nitrogen, carbon, and hydrogen, and this takes place in proportion as the augmented supply of oxygen may render it necessary.



§. 9.

Let us now look on the changes of the blood, as they are presented by chymical analysis.

Liebig, as also Becquerel and Rodier, has demonstrated, that the quantity of iron is exactly proportioned to the number of the red globules of the blood. Now if we examine the state of the blood, when the iron has been exhibited for several weeks, we shall find a striking increase of the red globules.

In one of the two cases, described by Andral and Gavaret, the quantity of red globules amounted,

before the use of iron, to  $\equiv 46,6$  } of 1000 parts  
after four weeks' use, to  $\equiv 95,7$  } of blood.

in the second case:

before the use of iron, to  $\equiv 49,7$   
after three weeks' use, to  $\equiv 64,3$ . <sup>1)</sup>

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<sup>1)</sup> First case.

|                           | bef. use of Iron. | after 4 weeks. |
|---------------------------|-------------------|----------------|
| Water . . . . .           | 866,5 . . . . .   | 818,5          |
| Fibrine . . . . .         | 3,0 . . . . .     | 2,5            |
| Red globules . . . . .    | 46,6 . . . . .    | 95,7           |
| Serous residuum . . . . . | 83,9 . . . . .    | 83,3.          |

According to an investigation by Herberger, the proportion of the quantity of red globules, before and after treatment with preparations of iron, was as 39 to 98.

In Loeffler's experiment the numerical proportion of the placenta before the use of the iron, was, of 1000 parts, 498,0, — after 30 days' exhibition 552,5; the oxyde of iron in 100 parts Ash = 0,8 previous to the iron, and 0,9 after.

Dr. Francis Simon, in his hand-book of practical medical Chymistry, communicates the result of the chymical investigation of the blood taken from a girl suffering from chlorosis, — both before the use of iron and after an exhibition of seven weeks. (2 ounces of a tincture and 64 grains in a metallic form). The alteration discovered in the mixture of the blood is so interesting, that I shall give the results of the examination in detail. The blood contained:

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| Second case. bef. use of Iron: after 3 weeks. |                 |        |
|---|-----------------|--------|
| Water . . . . .                               | 852,8 . . . . . | 831,5  |
| Fibrine . . . . .                             | 3,5 . . . . .   | 3,3    |
| Red globules . . . . .                        | 49,7 . . . . .  | 64,3   |
| Serous residuum . . . . .                     | 94,0 . . . . .  | 100,9. |

|   | bef. use of Iron. | after ditto. |
|---|-------------------|--------------|
| Water . . . . .                           | 871,500 . . . . . | 806,500      |
| Solids . . . . .                          | 128,500 . . . . . | 193,500      |
| Fibrine . . . . .                         | 2,080 . . . . .   | 1,200        |
| Fat . . . . .                             | 2,530 . . . . .   | 2,299        |
| Albumine . . . . .                        | 79,820 . . . . .  | 81,230       |
| Globuline . . . . .                       | 30,860 . . . . .  | 90,810       |
| Haematine . . . . .                       | 1,431 . . . . .   | 4,598        |
| Extractive matters and<br>salts . . . . . | 11,000 . . . . .  | 9,580.       |

The increase of the haemato-globuline in this case is most extraordinary, and offers a striking example of the efficacy of the iron.

The solid constituents of the blood increasing, while the water is diminishing in proportion, is a fact, which ought to fix our attention. In Simon's case, the former were augmented almost by the half. Andral and Gavaret found the water to be, before using iron = 866,5; after = 818,5; in a second observation = 852,8 before, and = 831,5 after.

In regard to the proteinous constituents the changes are not so steady. According to Simon the fibrine was diminished, also according to Andral and Gavaret (from 3,0 to

2,5; in another instance from 3,5 to 3,3), most probably because a greater portion of it was employed in new formations. Loeffler, however, found it increased, from 2,13 to 2,17.

The albuminous contents show a trifling addition. The statements respecting the extractive matters and salts are uncertain.

All experimenters agree upon one point, namely, that in proportion to these alterations in the mixture of the blood, those morbid appearances which depend upon a deficiency of iron diminish. If, therefore, we continue the use of the latter in such a manner as to preserve an harmonious relation of the four organic elements, we shall be able to supply the system gradually with that which is wanting, and thus remove the disease.

### §. 10.

The increase of tone brought on by iron is a secondary effect of this medicine, issuing from the more perfect oxydation of the blood. This is also the case with the astringent effect, which proceeds from absorption. Partly it may arise from an irritation directly produced on the

nerves of the relaxed organ by the additional quantity of oxygen in the blood; but it is, doubtless, chiefly to be attributed to an increase of the power of contraction, which, on diminution or removal of the abnormal condition of the blood, manifests itself principally in all fibrinous formations (muscles, coats of vessels).

The general action of iron on the muscular system is exhibited in an improved contractive power, easier play, and greater endurance.

Subordinately to the augmented activity of the collective nervous system, iron exercises a specific irritation on the nerves of the urinary and genital organs. — After an exhibition of 8—10 days, sometimes sooner, it produces a desire to void urine, an itching in the genitals (clitoris, fossa navicularis), and heightens the desire for sexual gratification. In the experiments of Loeffler, five cases out of six presented these symptoms in greater or less intensity.

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§. 11.

Highly important for our purpose is the discussion of the question, whether an admission of iron takes place through the external skin.

As we are not possessed of direct experiments, in which absorbed carbonate of iron has been found in the subcutaneous cellular membrane, in the blood or in the urine, we must content ourselves with inferences, drawn, partly, from the physiological results obtained by the application of other medicaments to the skin; and, partly, from the alterations which, on the exclusive outward exhibition of them, in spec. of chalybeates, have been manifested in several morbid conditions.

In regard to the first of these points, I shall take the liberty of reporting the results of a series of observations, collected by Krause.

Lebkuechner rubbed a solution of the Cyanate of Iron and Potash on the belly-skin of a rabbit and found it again on the inner side of the corium, and in the blood, chyle, excrements and urine; by several experiments, Westrumb found it, after hand and foot-baths, in



the urine and in the serum produced by blisters; the Cruor also seemed to present a slight, but distinct trace of it; applied to dogs, it was easily perceptible in the blood, and, in one case, even in the ductus thoracicus and the inguinal glands.

Alexander states, that, having taken a foot-bath of a solution of Nitrate of Potash, in which he stayed 15 minutes, a paper impregnated with the urine passed 10 minutes after the foot-bath, deflagrated in the same way as nitrate of Potash.

Schreger placed the leg of a dog in milk, in which nitrate of Potash had been dissolved; in the course of a quarter of an hour the lymphatic vessels had absorbed milk, and paper steeped in this, deflagrated on ignition.

Seguin laid dry Tartrate of Antimony on the skin, and changed the places daily; from the 6<sup>th</sup> — 10<sup>th</sup> day copious evacuations, without vomiting, succeeded, and these appearances occurred even earlier, if pustules had been formed. In one case, the quantity of the applied salt decreased by 5 grains in the course of 10 hours.

Madden, after rubbing his hands with Tartrate of Antimony, felt himself unwell and perspired; but in the urine no antimony was found.

Lebkuechner, after an embrocation with a highly concentrated solution of sugar of lead, observed poisoning and death; the subcutaneous cellular tissue was blackened by sulphuretted hydrogen; there were no proofs of the poison having penetrated farther.

After arm-baths of a solution of Hydroiodate of Potash, during 50 minutes, Jodine was found in the urine by Madden.

Bradner, Stuart, and Sewall, after foot-baths consisting of infusions of madder, curcuma, and rhubarb observed a correspondent colouring of the urine, which was much heightened by the addition of potash.

Westrumb asserts, that, after hand-and foot-baths, he found the colouring matter of rhubarb not only in the urine, but also in the blood, and serum produced by blisters.

If a frog be put into a small glass that does not admit of his moving himself, and into which a diluted solution of strychnin has previously been poured, so that only the hinder

extremities are wetted, symptoms of poisoning are soon manifested. In a similar experiment, Mueller employed prussiate of potash, and, by means of reagents, found it again in the body.

Mitscherlich placed several frogs in glasses, containing so much of a weak solution of common salt, saltpetre, or sal-ammoniac, that the animal was only partially covered. „They died within an hour, or later, according to the quantity of the dissolved salt.“ — In the subcutaneous cellular membrane a great quantity of water was discovered, the blood was dark and coagulated slowly, — had much serum. If, for these experiments, a solution of sulphate of iron with albumen was taken, the animals did not die before 24 to 48 hours; in these cases, no water was found in the cellular membrane, but the blood was thick, of a clear red, coagulated quickly, and with little serum.

If the hydrocyanate of Potash and Iron be added to an ordinary fresh-water-bath, the salt will after bathing, be found in the urine.

If emetic tartar, nitrate of potash, acetate of lead, hydroiodate of potash, hydrocyanate of potash, etc. etc., can, on external application, be

so easily introduced into the system, there is every reason for supposing, that a solution of a substance, which is so easily absorbed as the carbonate of iron, will not meet with greater difficulties.

Besides these physiological experiments, which all attest the absorbing capability of the skin, we are justified also, in drawing conclusions from the medicinal effect of several remedies, when exhibited solely in an external form. — On this point quicksilver affords us the best information: frequent rubbing with grey mercurial ointment is well known as a means of vivifying resorption: by it constitutional syphilis is cured, and salivation excited, even when the skin remains unaltered at the place of application. Gendrin, too, after similar frictions found metallic quicksilver in the lymphatic vessels under the skin. — The great efficacy of corrosive sublimate, when applied in baths, has been evidently proved by Wedekind. Hydroiodate of Potash, when employed in the same way, is known to be equally efficacious. Baths of broth, or milk are nutritious, although in an imperfect degree.

In conclusion, I may mention also the brilliant and rapid success frequently attending the outward application of mineralwaters, and more particularly of steel-baths.

With a very considerable portion of our patients, the water cannot be used inwardly otherwise than in very small doses, and sometimes the digestive powers are so prostrated, that we are obliged to renounce the internal exhibition and confine ourselves exclusively to outward application. In spite of this, however, the appetite improves, the patient gradually recovers his good looks, and the development of warmth is augmented (symptoms, arising solely from an addition of oxygen, i. e. iron, — to the blood).

## §. 12.

Besides water, carbonic acid and nitrogen, the following substances pass from within through the epithelium of the sudatory glands: lactic and acetic salts, sal-ammoniac, hydrochlorate of soda and of potash, oxyde of iron, phosphate of lime, etc. etc.; it is apparent, therefore, that, to the passage of carbonate of iron, from without to within, no physical obstacle



exists. Neither do the sebaceous glands of the skin offer any opposition. It is through these latter, and principally through the sudatory ducts, that the iron of the baths finds its way to the blood.

The metal is not able to penetrate the other part of the epidermis; this has been finely demonstrated in an experiment by Krause.

This philosopher laid pieces of the epidermis, taken from the sole of the foot, during periods varying from 1 to 3 days, some in a solution of hydrocyanate of potash and iron, others in one of sulphurate of copper; he then rinsed them well, and put the first into solutions of sesquichloride of iron and sulphate of copper, the latter into caustic ammonium and hydrocyanate of potash and iron. The whole surface of the pieces of skin became of a blue or brown colour. On making perpendicular intersections, „these colours were observed in the sides of the incision, only throughout the tissue of the corium with its papillae, in the lower stratum of the epidermis, in the middle stratum, where they began to grow fainter, and in the superficial cells of the outer cuticle; but



the latter remained uncoloured in the greater part of its thickness, and transparent, so that the hues of the strata, penetrated by the chymical substances, shone through; but the cuticle itself, even when touched with re-agents on the surfaces of the incision, underwent no change of colour whatever. “

## 2. Effect of the Carbonic Acid.

### §. 13.

Here, again, a distinction is to be made between the local and the general effect. In both respects carbonic acid shows itself as a mild and direct irritant of the nervous system.

a) Local effect. The purest effects of carbonic acid are obtained best by employing it in the form of gas, for the purpose of experiment.

If the gas be conveyed, through a tube, into the mouth, it causes a pricking on the tongue; conducted into the nose, it excites sneez-

ing; in the eye, it produces a burning sensation. The same is to be observed on application to the external skin (at first agreeable warmth, afterwards a burning and pricking sensation, — especially in the tender parts, such as the genitals, and mamillae, — a reddening of the skin, and finally sudatory secretions). The tranquilizing power of carbonic acid on the stomach is well known; this, however, does not depend on a narcotic, but on an alterative influence, inherent to its irritant quality, which it exercises on the nerves of the stomach. — The topical effect, on internal as well as external exhibition, is purely excitative for the nerves of the tractus intestinalis, and of the skin.

The consequences of the above are: accelerated intestinal digestion, increase of secretion and absorption in the intestinal canal, as also augmented activity of the skin in its double capacity of secreting and absorbing organ. The operation of carbonic acid is quite the same, whether it be separated from, or united with, water. The principal reason of this is, that it immediately escapes from the water, in the shape of gas, and settles in little

bubbles on the surface of those parts, which are washed by the water.

If we sit quietly, for a few minutes, in a bath of our mineral water, the whole skin is soon covered with vesicles, at first very small, and closely packed together; these grow to the size of a millet-grain, run into each other, and when they have attained the diameter of a line or a line and a half, or whenever any motion in the water takes place, ascend to the surface, and burst there. The skin assumes a lively red hue, and a feeling of warmth, burning and pricking, sometimes amounting to pain, arises.

We see this phenomenon in cold, tepid, and warm baths, and may therefore be assured, that it is not caused by the temperature of the water, but by the carbonic acid.

The same symptoms, which are observed on the skin, are produced in the mouth, throat, and stomach by water, containing carbonic acid, though in a less degree, than by pure carbonic acid. A portion of the gas is, in this case, speedily separated, and escapes in eructations.

b) General Effect. The gases which,

by mastication and deglutition of the food, are carried into the stomach, either pass away by the mouth and anus, or, according to the laws of endosmosis and exosmosis, pervade all the tissues of the body, and are expelled by means of the skin and lungs. A stomach, or intestine, filled with carbonic acid gas, hermetically closed, and suspended in the air, loses the whole of its contents in 24 hours. In the same manner as the coats of the dead stomach are penetrated by the gas, so also those of the living one. A proof of this is given by the frequent occurrence of speedy death after the enjoyment of wine in a state of fermentation. „The fermentation is augmented by the warmth of the stomach; the developed carbonic acid gas penetrates the coats of the stomach, the diaphragm, through all the skins into the cells of the lungs, and expels the atmospheric air. The individual expires with all the signs of suffocation in an irrespirable gas, and the surest proof of its presence in the lungs is, undoubtedly, the circumstance, that the inhalation of ammoniac gas is allowed to be the best counter-agent to this morbid condition.“ (Liebig.)

We have seen that, on internal exhibition, carbonic acid pervades the whole system; a similar effect attends its external application. Abernethy found, that his hand, placed in carbonic acid gas, had, in the course of nine hours, absorbed more than 6,25 cubic inches. A sparrow put into this gas, with its head protected, dies in an hour and a half or two hours.

According to the observations of Balling in Kissingen, the carbonic acid received through the skin, during whole or half-baths of carbonic acid gas, is, with a rumbling noise in the intestinal canal, expelled by the mouth and anus, an hour or two after bathing.

Carbonic acid, therefore, penetrates the whole body, and acts as a mild irritant on the collective nervous system. Balling asserts, that patients, after the use of whole-baths of this gas, were for several hours in excellent spirits, and felt great ease and lightness in all their movements.

This direct and invigorating power of carbonic acid on nervous life, is most clearly displayed in paralytic conditions. A case of paralysis of the right half of the body, once came



under my notice, and was so severe, that the patient could, with the exception of a few uncertain movements, make no use of his hand. He tried the baths of Schwalbach, and with the most decided success. A most striking circumstance was the change that always took place immediately after bathing. The patient was then able to walk a little, to hold objects in his hand, and to move his arm in all directions with facility. At the commencement of the course this favourable effect soon disappeared (in about 5 or 10 minutes), but in process of time became more durable. After six weeks' use of the waters, the patient, while sitting near the bath, he had just quitted, was able to write a short letter.

If, in the internal or external application of carbonic acid, a portion should be absorbed by the vascular system, the fact would be of no importance for the explanation of the general effect of this gas.

### 3. Effect of Water.

#### §. 14.

The local, as well as the general effect of water is determined by its liquid consistency, by its temperature, by the quantity of the water in proportion to that of the ingesta, and by the manner of the application.

a) Local operation. This depends on the temperature and method of application.

I shall here speak only of those degrees of temperature which, in using mineralwaters, can alone be taken into consideration, and merely remark, that water of 43 — 57° Fahr. is of the same signification for the stomach and intestinal canal, as 59 — 73° for the outer skin.

Water applied cold, in suitable, not too large quantity to the internal or external surface of the body, acts as a topical remedy, primarily, refreshing, abstractive of warmth, secondarily, irritant, and this in proportion to the coldness of the water. The sudden frigidity induces an organic re-action, the blood

runs with more energy to the place of application, where the redness, warmth and turgor vitalis increase. This may be seen best, by covering a part of the skin with a compress steeped in cold water, and allowing it to remain unrenewed; or, by syringing, or washing the part with cold water. At first chilliness ensues, but an agreeable warmth is soon diffused, and all the signs of heightened re-action become apparent. The same appearances are visible on remaining for a short period in a cold bath. On entering there is chilliness and shivering, but after a few minutes a sensation of comfortable warmth and reddening of the skin ensue.

But the very reverse of all this takes place, if the compress be exchanged for one equally cold, if the washing be continued, or if too long a stay be made in the bath. The re-action is then either entirely repressed, or, by a too rapid and considerable abstraction of warmth is annihilated shortly after commencement. The contraction of the vascular coats, produced by the continuous frigidity, drives the blood from the surface; the latter becomes pale

and insensible, the voluntary and involuntary motions of the organs beneath become gradually more difficult, local cramps arise, and finally torpor and paralysis ensue.

It appears, therefore, that different methods of applying the same remedy bring forth diametrically opposite results, and in this peculiar property of cold water may be found a partial elucidation of the great success attending its use in the hydropathic establishments.

The effect of the internal exhibition is perfectly similar to that of the external. Both by the temperature and the quantity of the water imbibed, the nerves of the intestinal canal may be irritated or depressed. Here, however, we have to consider the influence, which, by its direct relations to the alimentary matter, it exercises on the processes of chymi- and chylification.

Lukewarm water, taken inwardly, easily causes nausea and vomiting. As attending an outward application, a sedative effect on the cutaneous nerves has been observed, and by serving as a purificative, it promotes the absorbent and excretory functions of the skin.

Finally, warm water, when imbibed, acts, by the communication of its warmth, primarily irritant, secondarily relaxing. The same is the case if used externally. The skin, both by a direct reception of foreign, and by retention of the natural warmth, attains a higher temperature; the blood is attracted to the surface; there is stronger turgescence, a darker colour, easier play of the muscles, more lively sensibility and action in the nervous functions, accelerated interchange of the substances in the capillary-system. As soon as the artificial communication of warmth ceases, the body disburdens itself of the superfluity by increased cutaneous evaporation (sweat); the skin becomes thereby more sensible of external influences, and in it, as well as in all those structures, in which heightened activity had before prevailed, is now manifested, on the equilibrium being restored, a considerable relaxation, and in a greater or less degree, according to the duration of the warmth.

In regard to the manner of external application it only remains to be mentioned, that rapid cold ablutions, cold suffusions, and, above



all, the Douche, act as powerful irritants, and promoters of tone and contraction.

b) The general effect of water is to dilute the fluids, to promote the interchange of the textures, and to increase the secretions of the skin, lungs, and kidneys. Besides the influence of the temperature which coöperates with the local effect, the quantity contained in the body must also be taken into consideration. A mass of water too large in proportion to the solids of the blood must be weakening in all those diseases, in which the water of the fluids predominates per se; on the other hand, too sparing a use of water will induce a state of over-condensity of the fluid and solid elements. *Nulla reactio nisi fluida.*

### §. 15.

We have now to consider the question, whether water, on external application, be as well absorbed by the body, as it has been proved to be, when applied internally.

Respecting the absorbent capability of the skin, when deprived of the epidermis, no doubt

is entertained; but, whether the uninjured horny stratum of the epidermis can be penetrated by liquid substances, has been much questioned by many physiologists. Their opinion is grounded on the following experiments:

If the superficial capillaries of the Corium be ruptured by thin injections, and the liquid mass enter the rete Malpighii, the epidermis rises, but the fluid never penetrates it. Neither does any filtration of water ensue, when the epidermis is inflated by combustion, or a blister. Soemmering closed a small glass, full of water, with pieces of epidermis, and, after the lapse of several months, could observe no diminution of the fluid. Krause took a bent glass-tube, and filling the shorter limb with water, fastened over it a piece of corium with the epidermis; he then subjected the water to the pressure of a column of quicksilver 28 inches high. „After four and twenty hours the corium was completely soaked through, the epidermis had risen in vesicles, the larger of which had burst, whilst the smaller, up to nearly the diameter of a line, safely retained the water.“ The surface remained perfectly dry. The minutest mi-

microscopic investigations discover no pores in the epidermis. If two fluids of chymical affinity, or of different density be separated by a piece of epidermis, no permeation according to the laws of endosmosis and exosmosis ensues.

The result of these observations is correct, but they do not prove the impermeability of the epidermis. At the most, they only show, that the epidermis, when dead, has no openings. But, that, during its vitality previous to its separation from the corresponding part of the corium, such openings must have existed, is demonstrated by its anatomical construction. The horny stratum of the epidermis passes, at the excretory ducts of the sudatory canals and sebaceous glands, immediately into the epithelium of the latter. If, therefore, the epidermis be violently separated from the corium, the conjunction of the epithelium with the epidermis must be ruptured, and in this last, a hole will be formed. By reason of the oblique and tortuous direction of the ducts and the elasticity of the texture, this little hole closes in the moment of separation, and the epidermis then allows no passage to liquid substances.

During life, the case is very different.

The sudatory canals are, in their whole length, invested with an epithelium. It is one of the peculiarities of the epithelium, that it is easily penetrable by water. If, for instance, a piece of the urinary, or of the gall bladder be stretched over a glass tube filled with water, the outer surface will soon be covered with drops, and the quantity of water decrease. The covering of the sudatory canals, therefore, opposes no obstacle to the penetration of water.

The number of the sudatory glands is very great: Krause estimates them at about 2,381, 248. The quantity of water, which can be imbibed by their means, must therefore be very considerable, and may perhaps stand in a certain relation to the quantity of sweat, which, in a definite period, is secreted by the glands.

That all the water which may have been received into the body by baths, should pass through the sudatory glands, is to be doubted, as water, when it has assumed the form of vapour, penetrates, without difficulty, both the dead and living epidermis. F. Home observed that his weight increased 2 ounces in

7 hours; Jurine a similar increase of 18 ounces in one night: both had gone to bed hungry and fatigued. De Gorter, Keil, and Rye, in their investigations, remarked an augmentation of bodily weight, whenever the air was damp.

The following experiment of Krause's proves, that the vapour of water is able to penetrate also the dead epidermis. „A glass tube, filled with water, and closed at the bottom with epidermis, was placed air-tight in a glass containing freshly melted hydrochlorate of lime, lying about an inch below the epidermis. In all experiments of this nature, the latter, by partial liquefaction and by increase of weight, indicated the absorption of water, and this, several days together in very regular progression: on the first day, somewhat more than on the following ones, until that part of the skin which lay above the fastening thread, and was excluded from contact with the water, appeared perfectly desiccated. From the 2<sup>nd</sup> to the 5<sup>th</sup> day, the hydrochlorate of lime, the surface of the epidermis amounting to about 40 square lines, absorbed within 24 hours 1,7 to 2,6



grains of water.“ — An absorption of water from the air was impossible, as the glass had been hermetically closed. It appears, consequently, that the water evaporating in the bath is able to penetrate the epidermis in all places, and thus to enter the vascular system.

### §. 16.

Having indicated the way, which may be taken by liquid substances in order to effect a passage from the outer skin to the blood, I shall now adduce several experiments, which afford positive proof, that an absorption of water takes place through the epidermis, when uninjured.

The investigations of Cruikshank have shown, that, by baths, not only was the thirst quenched, but also that the urinary secretion, which from a want of liquid ingesta had been exhausted, was again restored. — W. Falconer found, that his hand, immersed up to the wrist in water of 112° Fahr., had, in a quarter of an hour, imbibed 98 grains of moisture.

Collard de Martigny (Magendie, Journ.,

T. XI., and Arch. gén. de Médecine, T. X.) made several experiments on different parts of the skin. He filled two vessels, of a similar form, with perfectly equal quantities of water at a temperature of  $23^{\circ}$ , 5 C.; in one, he immersed his arm for half an hour, and afterwardss reweighed both vessels, as well as the towel he had used. As the difference of weight in the vessels amounted to 68,47 grains, and the cloth had imbibed 22,67 gr., the arm must have absorbed 45,8 gr. of water. — In another experiment, he filled a funnel, of 25 lines in diameter, up to the brim with water, and placed it perpendicularly on his hand, with the spout upwards; in the course of half an hour he skin beneath was swollen, as if it had been under a cupping-glass, and the adhesion was considerable; when there was air in the funnel, this appearance was not exhibited, but a sinking of the water was observable. (Krause.)

Berthold has made four experiments with fresh-water baths; these I shall communicate *verbatim*.

1<sup>st</sup> Exp. On the 9<sup>th</sup> August 1835, Berthold took a bath of  $82^{\circ}$  F., 4 hours after din-

ner, with the air at  $63\frac{1}{2}$  F. The bath lasted a quarter of an hour.

His weight before bathing amounted to:

|                    |     |      |   |     |   |          |
|--------------------|-----|------|---|-----|---|----------|
|                    | 113 | lbs. | 7 | oz. | 5 | drachms. |
| after bathing, to  | 113 | "    | 8 | "   | " | "        |
| Increase of weight | —   | "    | — | "   | 3 | "        |

But according to Séguin, the body loses, by the ordinary exhalation of the lungs, every minute about 7 grains in weight, so that, to the above increase, 7 times  $15=105$  grains, or 1 Dr. 45 gr. must still be added, by which, the total weight of water, absorbed during the period indicated, amounts to 4 Dr. 45 gr.

2<sup>nd</sup> Exp. On the 11<sup>th</sup> August, 4 hours after dinner, Berthold took a bath of  $95^{\circ}$  F., during a quarter of an hour.

His weight before the bath was:

|                |     |      |    |     |   |     |    |     |
|----------------|-----|------|----|-----|---|-----|----|-----|
|                | 113 | lbs. | 9  | oz. | 5 | dr. | 17 | gr. |
| after the bath | 113 | "    | 10 | "   | " | "   | 8  | "   |
| Increase . . . | —   | "    | —  | "   | 2 | "   | 51 | "   |

The loss by pulmonary exhalation again reckoned at 1 dr. 45 gr., the whole quantity of water imbibed amounts to 4 dr. 36 gr.

3<sup>rd</sup> Exp. On 17<sup>th</sup> August, — the air at

68° F., — 3 hours after dinner. Temperature of bath 95° F., duration  $\frac{3}{4}$  of an hour.

Weight before bath = 113 lbs. 11 oz. 2 dr. „ gr.

„ after „ = 114 „ — „ 1 „ 20 „

Increase . . . . . = — „ — „ 7 „ 20 „

Now, if we reckon the loss by pulmonary exhalation at 7 grains a minute (in  $\frac{3}{4}$  of an hour 5 dr. 15 gr.) the increase of weight by cutaneous absorption will be found to be 1 oz. 4 dr. 35 gr.

4<sup>th</sup> Exp. On 18<sup>th</sup> August, the air at 68° F., 4 hours after dinner. Duration of the bath 1 hour; temperature 95° F.

Weight before bath = 113 lbs. 10 oz. 6 dr. 30 gr.

„ after „ = 113 „ 11 „ 7 „ — „

Increase . . . . . = — „ 1 „ — „ 38 „

To this we add the loss by the lungs (1 hour = 7 dr.); the total increase will be: 1 oz., 7 dr., 30 gr.

In the experiments of Berthold, no attention is paid to the weight of the matters, which may have been retained in the body by the suppressed or diminished cutaneous ex-

halation while in the bath. On this point Madden has made some very interesting investigations. (An exp. inquiry into the physiology of cutaneous absorption. Edinb. 1838.) He ascertained the loss of weight during the half hour previous to the bath, remained in the latter half an hour, with his head in an oiled bag (which, for the purpose of respiration, was provided with a tube leading from the window), and, after carefully drying himself, was immediately weighed. The results of nine observations with the barometer at 750 to 761 millim., and the temperature of the bath at  $29^{\circ}$ — $34^{\circ} \frac{1}{2}$  C. were: absolute increase of bodily weight between 202 grains and 1098; the increase of weight after deduction of the quantity of cutaneous exhalation, which before bathing had been calculated for the duration of half an hour, was between 170 and 817 grains.

Krause, in the second volume of Wagner's *Handwörterbuch der Physiologie*, p. 178, compares the results of Madden's observations with those of the experiments of Berthold. He adopts for the collective cutaneous evaporation, Séguin's average of 10,465 gr.



a minute, the exhalation of the head and neck at a ninth part of this sum, but for the loss by exspiration, in ordinary circumstances, only two thirds of the above-mentioned average, because Berthold breathed immediately above the surface of the water, and did not respire the arier air through a tube (therefore, only 4,651 gr. in a minute), and thus, in the experiments of Berthold, he finds the quantity of water really absorbed within half an hour, to be 499,5 gr. in a bath of 27,5 C. and 481,5 gr., 469,5 and 394,5 gr. in the baths of a temperature of 35 ° C.

The fact, that water penetrates into the body through the uninjured epidermis, is thus placed beyond doubt.

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## §. 17.

It is well known, that man, as long as he is exposed to the air, is enveloped in an atmosphere of vapour, formed by the perspiratio insensibilis. This atmosphere is in all probability produced by the secretion of the sudatory glands in their ordinary activity.

If, from any cause whatever, congestive appearances be formed in these glands, and the skin be subjected to a higher temperature, the secretion is increased, and sweat ensues.

But, if the body be transferred to water of a certain warmth, either the secretion of the skin ceases, or at the same time an absorption of water takes place (Exp. of Madden, Berthold etc.), or finally the secretion is augmented, in which case there is no absorption.

This difference in the secretive and absorptive activity of the skin is dependent on the temperature of the bath.

Let us return to Berthold's experiments, in order to see, how far the absorptive capability of the skin depends on the warmth of the bath.

The increase of weight amounted, in a bath of 82° Fahr. (calculated at half an hour) . . . . . to = 570 grains.  
 in the first bath of 95° F. ( $\frac{1}{2}$  hour) = 552 "  
 in the sec. " of " " = 503 "  
 in the third " of " " = 465 "

With these results let us compare the observations of N. L. Young.

He found that the weight of his body, in a bath of  $26^{\circ}$ ,  $67^{\circ}$  C. ( $79\frac{3}{4}^{\circ}$  F.) increased by 2550 gr. in an hour, pulse and animal warmth unchanged (therefore in  $\frac{1}{2}$  hour, 1275 gr.); in another bath of  $32^{\circ}$ ,  $22^{\circ}$  C. ( $90^{\circ}$  F.) there was an increase of 638 gr. in an hour, therefore in  $\frac{1}{2}$  hour, 319 gr.; — on the other hand, in a bath of  $37^{\circ}$ ,  $77^{\circ}$  C. ( $99\frac{1}{2}^{\circ}$  F.), there was neither increase nor diminution, the pulse accelerated, and the warmth of body augmented. Hereupon Krause very justly remarks, that in the last bath, absorption must have taken place, but that Young did not include in his calculation the loss arising from pulmonary exhalation. (Young respired, through a tube, the air of another room.)

Madden, in a 10<sup>th</sup> experiment, took a bath of  $36^{\circ}$ ,  $66^{\circ}$  C. ( $98\frac{1}{2}^{\circ}$  F.) during half an hour. „The perspiration broke out in torrents, and after bathing the pulse was 98.“ This time he lost in weight 1159 grains.

It is thus apparent, that in baths of  $79^{\circ}$  and  $82^{\circ}$  F. the skin imbibes more water than at higher temperatures; we see moreover, that absorption

in the bath ceases, and secretion takes place, whenever the body perspires.

The limit, at which absorption no longer takes place, has not been ascertained in the above-mentioned experiments; for, with Young, there was still absorption in a bath of  $99\frac{1}{2}$  F., whilst in that of  $98\frac{1}{2}$  F., which Madden took, not only did no imbibition occur, but even a considerable loss was proved.

This seeming contradiction is to be explained by the individuality of the bathers.

Plethoric, vigorous persons, in whom there exists a strong reaction outwards and greater development of warmth, will, at a low temperature, take in no more, than those, whose blood is poor, and whose constitutions are weak. Absorption takes place up to the point at which the sudatory secretion commences, and it is a well ascertained fact, that anaemic persons can bathe much warmer, without perspiring, than plethoric.

As a consequence of the foregoing, we may be justified in assuming, that, the limit at which absorption is reduced to nothing, or at most, to the quan-

tity lost by pulmonary expiration, - is the individual temperature of the blood. In cooler baths imbibition takes place, in warmer ones an excretion of the body ensues.

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#### 4) Reciprocal Relation of the principal elements of our Mineral Water.

##### §. 18.

The chalybeates are a compound medicine. As in prescribing such a remedy, not only the choice of the ingredients, but also their form and combination, as well as the doses must be considered, so in forming a judgement as to the effect of mineral waters, due regard must be paid to the quantitative proportion of the individual effective constituents, to their relation to each other, and to the nearest chymical combinations, in which the same occur in the water.

As it not in our power, to change the composition of mineral-water at pleasure, we must choose from among the different sources, that one, which may be most suitable to the disease.



In this selection we may be directed by the results of the qualitative and quantitative analyses, as well as by any peculiarities, with which experience may have made us acquainted.

Setting aside all other circumstances, a water, that contains much iron and little carbonic acid, will be difficult of digestion; one, that is rich in this acid, easily irritant; and a third, in which these two constituents are but sparingly distributed, can only be of material efficacy on continuous application, or in large doses.

### §. 19.

Iron appears in mineral-waters, either as a protoxyde of carbonate, or as a protoxyde of sulphate. Combinations with chlorine are rare.

Among the salts just mentioned, the carbonate of iron, on account of its tonic power and great facility of digestion, is to be preferred in those cases, which require a prolonged use of this metal. It constitutes the basis of a number of officinal formulae, many of which have obtained considerable reputation; Ex. gr. of the *pulvis aërophorus martiatus Hufelandi*, of the *Mellite ferrugineux*

of Vallet, of Brandes's pills, of Griffith's mixture, of Blaud's pills, of the pulvis ferri of Menzer.

The sulphate of iron is principally astringent, but is not suited to a lengthened exhibition, as it is apt to cause pains in the stomach, vomiting and other disturbances of the digestive process.

These observations on the salts, are equally applicable to the mineral-waters in which they are dissolved.

## §. 20.

Our steel-waters contain but an insignificant proportion of the salts of soda, potash, magnesia, lime and manganese, and their operation is quite subordinate to that of the iron. As promoters of resorption, they are often valuable adjuncts, and occasion a slight difference in the effects of the Schwalbach springs; but, whether they stand in a direct relation to the composition of the blood, cannot be ascertained, inasmuch, as proofs of constant alterations of the saline contents of the blood among our patients have not yet been established.

§. 21.

When judging of the operation of chalybeate waters, we must not forget the influence exercised by the carbonic acid on the iron of the water.

Carbonate of iron is well known to be insoluble in fresh-water, but in water containing carbonic acid it is easily dissolved. The superabundant carbonic acid keeps it in a liquid state.

A water which allows the carbonic acid gas to escape rapidly, must therefore undergo a speedy precipitation of its iron, a circumstance which, in the external application, as well as for the use of the minerals at a distance from the well, is of the utmost importance.

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5. Effect of the Schwalbach waters when considered in their totality.

§. 22.

The effect of these waters in general is established as follows: Improved digestion, promotion of absorption, amelioration of the mix-

ture of the blood by enrichment with the four organic principles, augmented excretion of exhausted matter, and gentle irritation of the nervous system.

When, in those cases, in which it is indicated, our mineral-water is introduced into the body in doses corresponding to the individuality, we observe as a first effect, that the appetite improves, and the alvine evacuations become more rare.

These consequences of the primary (local) effect of carbonic acid and iron, are generally manifested after a few days' exhibition. Oppression and flatulency after eating are removed, a slimy tongue becomes cleaner, and the taste more agreeable. If the water agrees with the patient, in the subsequent progress of the course, his appetite continually increases (secondary effect), and often in an incredible degree. It sometimes borders on the miraculous, what quantities of food are taken, during the exhibition of our mineral-water, by weak girls, incapable of any exertion, and who, nevertheless, experience no inconvenience from this surplus of nourishment.

The changes dependent on the general effect of the iron, are, usually, not distinctly observable till the second or third week of the course. A principal feature in these changes is the feeling of augmented vigor. Patients, who at first could scarcely drag themselves to the bathing-house, and, however short the distance, were obliged to rest by the way, soon begin to venture on short walks, which gradually become longer, and, at the termination of the season, are frequently able to reach the more distant places of resort on foot. Utterly exhausted before by a quarter of an hour's walk, they, at a later period, seldom experience fatigue from a promenade of one or two hours, or even more. The whole appearance improves, the lips, tongue, gums, and eventually the cheeks, lose their cadaverous paleness, and receive a blooming, rosy tinge; the complexion becomes clearer, the skin more transparent and the veins more prominent, oedematous swellings disappear, and, in general, there is more turgor in the whole habit. As the contractions of the heart are more vigorous, the circulation is accelerated, and the weak, frequent, wiry pulse



becomes stronger, slower, and fuller. The retardation of the pulse is a constant symptom attending the use of iron, and does not fail to exist even when the latter is administered in a normal state of blood.

In Loeffler's experiment the normal pulse was 75; during the use of the iron it was reduced by 2 – 4 strokes a day, so that at the end of the period (26<sup>th</sup> July) only 54 strokes were counted. As soon as the medicine was no longer employed, the pulsations resumed their former frequency. — *Le bruit de diable*, or buzzing sound in the vessels of the neck, which had before been intermitting, ceases. The tightness of the chest and the palpitations of the heart disappear. Abnormal secretions and excretions, especially from the genitals (*fluor albus*, *metrorrhagia*, involuntary emissions of semen, *gleets*) are diminished, and by degrees removed; it is also of frequent occurrence, that, soon after the exhibition of the waters, pregnancy ensues. — In cases of retention or suppression of the menstrual flux, great benefit is derived from our minerals, as we find the discharge produced sometimes even during the

course, at first weak, but soon more copious, and without pain. In proportion to the accession of iron to the blood, do nervous symptoms disappear (at the beginning of the cure music is often sedulously avoided, and occasions convulsions, but after a short time, patients exhibit the same eagerness in seeking it, that they formerly showed in removing themselves from the sphere of its influence). The inclination to chilliness and the disposition to take cold disappear. The gloomy creations of a morbid imagination, and the peevish whims of caprice give way to a tranquil, contented state of mind. That the excretions by the lungs, skin, and kidneys augment in direct progression with the process of oxydation in the capillary system, is a fact requiring no special confirmation. (In Loeffler's experiment the specific gravity of the urine before the use of iron was 1,005, — after, 1,025.)

### §. 23.

As a main difference in the effects of the three principal springs of Schwalbach, it is worthy of mention, — that the

Weinbrunnen is purely tonic and not irritant, similar to cortex Chinae, — that the Stahlbrunnen is a vigorous astringent comparable to cortex Cinnamomi, — and that the Paulinenbrunnen acts as a mild tonic, possessing at the same time a resolvent power, like rhubarb; but, as this water contains a large quantity of carbonic acid, it is slightly irritant.

These peculiarities in the effects of the different wells may serve as guides in the choice of a spring, both for internal and external exhibition. It remains to be mentioned, that the Paulinenbrunnen when mixed with the Rosenbrunnen, which abounds in iron, furnishes a bath, that is not to be excelled by those of either of the other sources.

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## II. Influence of local Circumstances on the treatment.

### §. 24.

Vogt, in his pharmacodynamics, says: „All medical men agree, that steel-waters are much more easily digested and supported, than arti-

ficial preparations of iron; and also, that, though often containing but trifling quantities of metal, their operation is much more effective.“

Vogt means the waters when drunk at the spring, and, from this point of view, he is incontestably in the right.

Attendant on a methodical use of chalybeates at the spring, there is, apart from the efficacy of the waters, a union of so many momenta whose high importance has long been acknowledged by experience, that the impartial examiner cannot hesitate in the choice of the remedy.

The importance of the subject induces me to give a brief notice of the principal momenta.

1) The water is in the state in which Nature produced it.

All mineral-waters lose by conveyance, and by keeping; more especially, chalybeates which are impregnated with carbonic acid gas. The carbonic acid, which holds the iron in solution, escapes, and the metal sinks to the bottom of the bottle; this takes place the sooner, the less carefully the water is protected from the air.

In this respect there is a difference in the wells, and the method of filling, as well as the form and consistency of the bottles, is not without influence; but no natural chalybeate, however carefully managed, can be preserved for a lengthened period, without undergoing a change. At the spring alone it is to be had genuine; the longer it has been kept, the less iron, in a state of solution, does it contain.

2) With the internal exhibition, the external application can be combined.

The great efficacy of baths is so generally admitted, that any expatiation on this point is unnecessary.

3) The patient no longer lives and moves in that atmosphere, in which he became ill, and which may have had its share in bringing on the malady.

Removal of the primary cause of disease is a chief requisite in the treatment of all, and particularly of chronic maladies. The patient must therefore be withdrawn from populous cities, where the air contains less oxygen, and is impregnated with deleterious admixtures; he



must be taken from a life, in which the day is turned into night, and the night into day; he must manfully resist the temptations of the table, and flee protracted banquets, with their highly-seasoned luxuries; he must avoid those noisy pleasures which keep body and mind in continual excitement; he must quit the relaxing atmosphere of large establishments, and withdraw from the fatigues of business or the oppression of domestic misery.

4) At bathing-places, and especially at chalybeate springs the patient enters on a mode of life the very reverse of that, in which he became ill.

Almost all mineral springs are situated in mountainous regions, the chalybeates, generally high above the level of the sea, — in thickly wooded districts, — at a distance from stagnant waters, — either quite isolated, or in the vicinity of only small towns. The air is therefore pure, rich in oxygen, and not disposing to typhous, or intermitting diseases <sup>1)</sup>).

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<sup>1)</sup> Formerly the proportion of oxygen in the air was supposed to be the same everywhere, at any

The exhibition of the mineral-water begins in the morning hours. The patient must therefore give up his old habit of lying in bed till noon; in return for this, he may be sure, that, if he follow the directions given him, he will be glad to retire to rest in the evening. — He must take plenty of exercise, and his food should be simple, nourishing, and digestible.

It is fortunate for the patient, that a little bathing-place cannot offer the distracting pleasures of a large city; that he can find neither theatres, nor concerts; that no gaming table puts his firmness to the test; that his only amuse-

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altitude, on the sea and on the land; but later, and more exact investigations have demonstrated certain fluctuations. Dumas and Boussingault assumed, that dry atmospheric air contained, according to the weight, 23 p. c. of oxygen, and 77 p. c. of nitrogen, and, as water absorbs oxygen much easier than nitrogen, it follows, that the air of the sea must contain less of the former, than the air of the land. (Levy Morren.)

Also Bravais, Brunner and Valentin have made very careful analyses of the air, from which it appears, that the fluctuations in the quantity of oxygen may amount to 1 p. c.

ments are a walk, ride, or drive in a smiling country, in a visit to some friend, in a shooting party, etc. etc.

5) The distribution of the daily employments depends solely upon the periods appointed for drinking and bathing. The latter is the main point in the treatment, and is therefore attended to with assiduity (though sometimes not without constraint).

6) Dulce est, socios habere malorum.

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## C.

# Indications for the exhibition of the Schwalbach Mineral-water.

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### §. 25.

Were I to continue in the course till now pursued, this chapter would present a register of human infirmities, not much shorter than that of special pathology. Let any publication on mineral-waters be taken up, and all the maladies be counted, for which a cure is promised: verily, their name is Legion. And what is most striking, we find the very same complaints enumerated as indications for the most different waters. Thus, to mention only a few, we find haemorrhoidal discharges, metrorrhagia, fluor albus, dyspeptic complaints, cardialgia, megrim, etc. etc. treated of in works on saline, and on chalybeate waters, although these two

remedies are, in their operation, diametrically opposed to each other.

This seeming inconsistency is attributable to the superficial manner in which the subject has been handled. It was deemed sufficient to present such easily comprehensible delineations of disease, as were offered by the most evident phenomena; but, to go deeper into the question, and to arrive at the general causes on which the outward signs were grounded, — this was neglected. Later investigations in pathological anatomy have, however, operated here most beneficially.

If we subject those changes of the system, which may be considered as occasional of the maladies mentioned above, to a careful investigation, we shall discover several conditions, materially differing from each other. Intestinal obstructions, or a repletion of the blood-vessels may just as well be the cause of hæmorrhages, as debility in the coats of the bleeding organ, or tenuity of the blood. The same nervous attacks are equally the consequences of morbid depositions, or of anæmic composition of the blood, or of pri-



mary morbosity of the nervous system. Thus we see, that it is not the haemorrhage, not the perverted manifestation of the nervous action which contains the indication of the remedy, but the morbid dispositions, the tenuity of the blood, or local debility. These latter conditions must, as independent diseases, be placed first in the indications, and then the abnormalities which had hitherto usurped the name of indications fall under the rubric of causes. We shall thus in every case come nearer to the essence of the diseases, and simplify the list of infirmities which find their cure in one or the other description of waters.

Proceeding from this point of view, we obtain as indications for the Schwalbach minerals two morbid conditions, one of which answers to the local, the other to the general effect, viz: Local weakness, and tenuity (poorness) of the blood.

## §. 26.

**I. Tenuity of the blood.** — In contradistinction to the second indication, this may be denominated general weakness.

I understand hereby that constitution of the blood, to which by some the very indefinite appellation of „pure atony“, by others, the better term of anaemia has been given. Its anatomical character may be briefly comprehended in the following:

1) The number of red globules is considerably diminished, and their paucity stands in direct proportion to the intensity of the disease. The normal number, in 1000 parts of blood, is 127, but Andral and Gavarret found them, in a case of anaemia, reduced to 47, and in one instance even to 28; Becquerel and Rodier to 95, Foedisch to 85, and Lecanu to 55.

2) Iron is present in smaller quantity. In normal blood the proportion for iron is in  $1000 = 0,51$ , at the utmost  $= 0,57$ ; in anaemia  $= 0,31$ , and often still less.

3) The quantity of water is increased. According to Foedisch the water in 1000 pts. of blood in a healthy woman was  $= 756,87$ , in another instance  $= 733,73$ ; on the other hand in Chlorosis, in one case  $= 806,28$ , in another,  $= 810,75$ . Lecanu found the proportion for

the water of the whole blood in a chlorotic person = 862,40. According to the analyses of Jennings, in two very pronounced cases of Chlorosis, the blood contained 871 and 852 parts of water, instead of 750, which is the usual quantity.

As with the blood in its totality, so is it, in this respect, with the plasma of the blood.

According to Andral and Gavaret the quantity of water in 1000 pts. of the plasma of a chlorotic patient was 907, in a case of great debility 935, whilst, when the blood is in a normal state, the average amounts to 904. After the calculations of Becquerel and Rodier, the average, in a state of health, is 907, in anaemia 909.

4) The specific gravity is less. Zimmermann found the mean proportion in healthy persons to be 1056, while the average in 30 anaemic persons, examined by Becquerel and Rodier, amounted to 1047 for the whipped blood, and 1017 for the serum.

5) The blood is of a lighter colour, of slighter consistency, and of a less capacity for warmth.

6) Blood drawn from anaemic persons coagulates quicker than that of the healthy, and the period requisite for coagulation is in exact proportion to the density of the fluid. The placenta is smaller and firmer, the quantity of serum larger <sup>1)</sup>).

This peculiar composition of the blood furnishes the most important indication for our mineral-water; and it is a matter of indifference in this respect, whether such a state of the blood has been superinduced by a faulty physical education (as in chlorosis), by residence in a corrupted atmosphere (as in the anaemia of marshy districts, of workers in metal), by the bad quality of the aliments or a deficiency in the quantity; or, whether it

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<sup>1)</sup> These alterations, varying from 1—6, have been indicated by all observers as the constant signs of anaemic constitution. Less harmonious are the reports in regard to the quantities of the other elements of the blood. Fibrine, Albumine, Fat, Salts, and Extractive-matters, have been discovered in greater or less proportions. In all probability, the number of the white globules is augmented in anaemia,

has arisen from inactivity of the sanguino-poietic organs (as in dyspepsia, apepsia, accumulations of worms, in many liver-complaints, impaired functions of the lungs, or heart, in continued mental depression); it is the same, whether this morbid tenuity has been produced by too great a consumption of the fluids (as in acute, and especially in nervous diseases, in profuse, or frequently recurring slight haemorrhages, in chronic diarrhoeas, considerable secretions of mucus from the rectum, the vagina, the urinary bladder, the air-tubes); or, by rapid growth, excessive bodily exertion, frequent or successive deliveries, and long suckling, by excess in venery, by onanism, frequent involuntary emissions of semen, by the abuse of weakening medicines, particularly of purgatives and metals; — whether it occurs at the period of development, or at a riper age, in either sex.

It will scarcely be necessary to remark, that diseases, which may have produced this constitution of the blood, or are coexistent with it, must previously be removed, should they be of a nature to be heightened by the use of



mineral-water. I must also mention, that irritability of the nervous system, even when caused solely by abnormal blood, must first be reduced, whenever it manifests itself excentrically.

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§. 27.

II. Local weakness, i. e. infirmity of an organ brought on by its relaxation. This may occur simultaneously with general debility, it may be the cause, or the consequence of the same, or may exist independently.

Of this sort of weakness, as it appears in different organs, I shall speak but briefly, as professional men, for whom alone my observations are intended, will be satisfied with a short enumeration.

a) Weakness of the skin, with a tendency to profuse perspiration, or predisposition to take cold.

b) Debility of either the whole nervous system, or of a part of it. The former appears, as a rule, in the form of hysterical excitability, — the latter in that of paralysis.

Strictly speaking, the general alienation of the nerves does not belong to our immediate subject, but falls under the head of general weakness, as the steel-waters are indicated solely for those forms, which are the result of an anaemic constitution.

I have considered it my duty to make particular mention of this circumstance, as every year hysterical patients are sent to our wells, but their complaints, being based upon primary morbidity of the nervous system, do not allow of the exhibition of chalybeates. If the composition of the blood be normal, no cure of nervous excitability is to be expected from the Schwalbach springs. In such cases, Ems, Schlanbad etc. etc. are indicated.

c) Weakness of the coats of vessels, occasioning haemorrhages (E. g. individual forms of haemorrhoids, metrorrhagia, epistaxis).

d) Weakness of the stomach and tractus intestinalis, appearing with the symptoms of dyspepsia, apepsia, pyrosis, flatulence, costiveness, diarrhoea, or accumulations of worms.

e) Weakness of the mucous mem-

branes of the lungs, bladder, urethra, vagina (profuse mucous cough, individual forms of the catarrhus vesicae, gleet, fluor albus).

f) Weakness of the female organs of generation, which may show itself in an inclination to abortus, in sterility, prolapsus vaginae et uteri, fluor albus.

g) Weakness of the male organs of generation.

Among the forms of disease quoted above, those which most frequently offer themselves to observation in our bath-practice, are: Anaemia in consequence of debilitating losses, chlorosis, hysterical excitability of the nervous system, fluor albus, metrorrhagia, and predisposition to abortus.

The Schwalbach waters are often employed as the second remedy, when sedative or resolving waters have been exhibited with success, and mostly in those cases, where, collaterally with one of the maladies mentioned above, irritability of the nervous system or obstructions of the intestines have prevailed to such a degree, that it was necessary to attend first to the latter complaints, before thinking of the debility.

The indications being correctly given, an enumeration of contra-indications would be superfluous; they are therefore omitted.

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## **D.**

# **Method of applying the Schwalbach Mineral Waters.**

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### **I. The season for the course of waters.**

#### **§. 28.**

The waters at Schwalbach are not to be taken in winter. On the other hand, quite devoid of foundation is the belief so firmly rooted in the minds of the public, that only the months of July and August are suitable for the use of this chalybeate.

If we but refer to the meteorological notices, communicated in the first part of this work, we shall find, that May and June are particularly qualified for this purpose. The mean temperature of May was in 1844 = + 55 ° F.; 1845 = + 53 ½; 1846 = + 57; 1847 = + 61; that of September was 1844 = + 56; 1845



$= + 54\frac{1}{2}$ ; 1846  $= + 57$ ; 1847  $= + 53^{\circ}$  F. — The mean height of the Barometer was in May 1844  $= 27'' 9'''$ ; 1845  $= 27'' 5,4'''$ ; 1846  $= 27'' 7,5'''$ ; 1847  $= 27'' 7,67'''$ ; in September 1844  $= 27'' 8,25'''$ ; 1845  $= 27'' 9,9'''$ ; 1846  $= 27'' 6,8'''$ , and 1847  $= 27'' 7,36'''$ .

In the middle of July, and principally during the month of August, the summer-diarrhoea, peculiar to Germany and from which Schwalbach is not exempt, makes its appearance. Interruptions of the cure are, therefore, more frequently occasioned than at an earlier period of the season.

As a rule, the months of May and June are delicious in our mountains. After a winter generally rather severe, spring appears as if by magic, and brings blossoms and luxuriant verdure only a few days later than in the more favoured Rheingau.

To patients in a very debilitated condition, I should particularly recommend an early visit to our bath, in order that they may escape the crowd and bustle of the later season; that the treatment may not be hurried, and that time may remain for a suitable after-cure.

## II. Preliminary Treatment.

### §. 29.

It is certainly not without justice, that, in most works on sanative springs, the utmost importance is attached to a medicinal-dietetic regimen, as a preliminary to the mineral course; and with no class of patients is this perhaps more necessary, than with the greater number of those who resort to our waters.

With many of these, the sole cause of malady is attributable to faulty habits of life, to which they have been accustomed sometimes even from the cradle. As with such individuals disease has become a sort of habit, it is only by degrees that we must wean them from their accustomed errors, and gradually lead them to an opposite system. To do this, is the object of the preparatory treatment. Let the patient be withdrawn from his ordinary domestic circumstances, let him reside a few weeks in a dry, airy part of the country; let him accustom himself, by little and little, to leave his bed at an earlier hour, and to remain

longer in the open air; he should take daily walks, proportioned to his strength; his food should be simple and easy of digestion, and everything about him should be conducive to a cheerful state of mind: the use of medicaments, often administered too liberally, should be discontinued.

If disease exist in a sanguino-poietic organ, or if obstructions in the principal intestines are present, let them be removed.

During the whole sanative course, and chiefly during the period of preparation, particular attention is to be paid to the nervous irritability already alluded to. It must, even when super-induced solely by the vitiated state of the blood, be reduced as much as possible in all those cases, in which its manifestations are excentric. If this be not done, the patient is often unable to bear strengthening remedies. This nervous state requires, above all, the removal of all noxious agents, repose of mind and body, a simple, natural way of life; to this may be joined the use of weak acids, of aqua lauro-cerasi in small doses, and especially of tepid freshwater-baths with a de-

coction of malt, or bran. If the patient's circumstances allow it, I should recommend his making a stay of two or three weeks at Schlengenbad, the sedative baths and retired, picturesque situation of which afford everything desirable for a preparatory treatment. It is also to be remarked that the whey-cure can be made here; the whey is prepared in the same manner, as in the well-known establishments of Switzerland.

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### III. Principal Treatment.

#### §. 30.

The journey hither ought to be performed, in every respect, in a manner suited to the strength of the patient, and the first few days after his arrival should be devoted to reposing from the fatigues of the journey, previous to commencing the course. The success of the course depends greatly upon the maintenance of a tranquil, cheerful state of mind. *Curæ vacuus hunc adeas locum, ut morborum vacuus abire queas. Non enim hic cu-*

ratur, qui curat, was the inscription over the baths of Antonine.

It is therefore desirable, that the invalid should bring with him some dear companion, who may undertake the superintendence of domestic concerns, and, by cheerful, sympathising conversation may banish the gloomy representations of a diseased fancy, and relieve the somewhat monotonous way of life, to which he, for a time, is obliged to submit. Very debilitated and despondent patients ought never to visit a bathing-place alone, or accompanied merely by their servants.

I should particularly advise mothers never, if possible, to bring children with them, as by the more or less considerable indispositions of the same, the cure is often interrupted, and in many cases totally frustrated.

The number of dwellings, destined to the reception of strangers, being quite sufficient for the demand, it is not necessary to bespeak lodgings etc. beforehand. Those in less affluent circumstances, may be assured that they will be respectably suited on the most reasonable terms.



Every invalid is recommended to provide himself with a detailed account of his malady from the home-physician.

## 1. Choice of the Spring.

### §. 31.

The peculiarities, already mentioned, of the chymical composition and effect of the respective springs, will serve as a guide in this choice.

The Paulinenbrunnen is pointed out for trifling degrees of those complaints, for which steel-waters are indicated, for great predisposition to constipation, for not very considerable depositions, collateral with the principal disease; and wherever in the habitus, or morbid phenomena, a certain torpidity is observable. It forms an excellent medium for transition from resolvent medicines to the stronger wells. By reason of its considerable amount of carbonic acid, it is of the greatest efficacy where there is a disposition to take cold, or a relaxation of the cutaneous organ.

The powerfully astringent Stahlbrunnen is indicated for Profluvia (Diarrhoea, haemor-

rhages, mucous secretions) in dislocations of the womb, etc.

The Weinbrunnen, finally, is adapted for those cases, in which the sanguineous life is greatly prostrated, or in which irritation in the nervous system is either present, or to be apprehended.

In general, patients are enjoined to use only one spring at the same period; but, in a mixture of morbid conditions, the simultaneous application of two wells is to be preferred, and a transition to the more powerful Weinbrunnen always to be recommended, as soon as the momenta, which induced the selection of the Paulinen- or Stahlbrunnen, shall have been removed.

If the patient is properly prepared for the course of waters, we shall seldom see ourselves under the necessity of uniting with the external use of our wells, the internal exhibition of an other mineral-water. Where, however, this condition has not been fulfilled, we prescribe, for drinking, the Soden, Homburg, Kissingen, Ems waters, whey etc.

## 2. Regimen during the Course.

### §. 32.

The treatment of those diseases, for which chalybeates are indicated, must be conducted with the greatest caution, calmness, and patience. The slumbering spark of vitality, which, in many cases, had been glimmering for years, can only by a gradual and cautious supply of animating, tonic substances be nourished, and fanned into a joyous flame.

At the commencement of the treatment I should recommend even a pedantic forbearance; it is better to do too little than too much, and we may progress more rapidly, on observing that the water agrees with the patient, and displays its invigorating effects. If, after the lapse of two or three weeks, no signs of disturbance, occasioned by the remedy, appear; if symptoms of an improved composition of the blood are manifested, then we may feel ourselves at liberty to do more.

A most particular degree of caution is demanded by those forms, in which great irri-

tability of the nervous system predominates. That mild nervous exciter and powerful auxiliary in the cure, the carbonic acid, may, as also the oxygen, occasion a highly injurious irritation, if applied too copiously or too rapidly to the body, in cases of excentric nervous manifestations. It is the task of the physician at the wells to control carefully all the motions of the nervous life. They are for him a barometer, the rise or fall of which furnishes the sole criterion for his future prescriptions, and if he attends to its fluctuations, he may be sure of ultimate success.

Referring to what I have just said, I shall now give a short sketch of the method of applying the water, both internally and externally, as also of the dietetic regimen to be observed during the course.

As the forms of disease are so multifarious, it is quite impossible to give special rules, adapted to every case: much must be left to the judgement of the physician. In general, only the following remarks:

§. 33.

With all patients suffering from general debility, both the inward, and outward exhibition should be tried, if not forbidden by particular abnormalities of the tractus intestinalis, of the skin, or perhaps by idiosyncrasies.

In topical weakness, the seat of the disease furnishes the guiding momenta for the one or the other method of application.

§. 34.

a) Division of the Day. In the hot days of July and August the wells begin to be visited at 6 a. m. and even at 5; in May, June und September, an hour or an hour and a half later. Though early rising is, as a rule, highly conducive to health, yet, for persons in a state of great debility, it is most injurious, at least in the beginning of the course. On awaking they usually feel themselves much fatigued and relaxed, mentally and bodily, and if they quit the bed too early, do not recover



themselves the whole day. They should, therefore, be allowed an hour's additional rest, but in fine weather the window ought to be opened, that they may enjoy the refreshing air of the morning. As soon as they acquire more strength, they must get up earlier.

In the majority of cases the water is administered at the same time internally and externally. The patient drinks the water, fasting; breakfasts half an hour after the last glass, takes his bath at 9 — 10 — 11, and dines at one.

The greater number of our patients can bear the water only in small doses. In such cases, one or two repetitions during the day are much to be recommended: about an hour before dinner, and at five or six in the evening. Bathing more than once a day is injurious.

Some of our patients bathe before breakfast, about half an hour or an hour after having risen. To these, in general, the internal use of the water has been forbidden, or is unnecessary.

That individual cases, and especially the

weather, form exceptions to this general rule, scarcely requires to be mentioned.

At about seven o'clock, a frugal supper may be taken, and at nine or ten the patient retires to rest.

### §. 35.

b) Regimen when drinking the water. The intestinal canal is pre-eminently an absorbent, the skin rather an excretive organ. By the first mode of exhibition, therefore, much more iron will be incorporated with the organism in a definite period, than by the second.

It is, however, an essential condition, that the stomach and intestinal canal should possess a certain degree of vigor, without which the iron cannot be supported, and, above all, will not be able to enter the secondary ways.

The inward use of the water requires particular caution in irritability of the nervous system.

The principal rules of the drinking-cure are as follows:

α. The water should be drunk, only when fasting. The iron of the water must be absorbed, and this can take place effectively, only when the stomach is not incumbered with food. The best time for drinking is, therefore, early in the morning; then an hour before dinner, and in the evening at 5 or 6.

The majority of our guests take the water at the spring, cold, and on an empty stomach. But with very debilitated patients this cannot always be done. On the first day we must often allow them a cup of coffee without bread, and the addition of warm water, or warm milk to the first glass of mineral-water. In a short time, they, while fasting, bear the water without any admixture. In cases of great weakness, it is often necessary to administer the water in the room, and sometimes in bed.

β. Too much must not be drunk at one time. The number of glasses is to be regulated by the digestive power and the irritability of the nervous system. As neither can be judged of a priori, we must ascertain the proper quantity by cautious experiment.

Torpid patients will be able to support

more copious doses at the very commencement (2—3 times,  $\frac{1}{2}$  glass); but with erethic, it is advisable to begin with a quarter, or half a glass as the morning dose.

If taking the water in the morning hours has produced no injurious effect, the patient may imbibe a small quantity towards evening; also an hour before dinner.

I unhesitatingly prefer, that the water should be drunk at repeated intervals in the course of the day, to inundating the stomach with a mass of water before breakfast.

As long as the quantity of water, prescribed for the morning, is small, more than a quarter or half a glass ( $1\frac{1}{2}$  — 3 oz.) ought never to be taken at once; the dose may be repeated, when the portion already swallowed no longer occasions a sense of pressure in the stomach (in about  $\frac{1}{4}$  or  $\frac{1}{2}$  hour).

If the patient finds that the water agrees with him, the number of glasses may be cautiously augmented, and in like manner the quantity of the various doses. During the height of the course, we may often allow 4—6 glasses in the morning, 1 at noon, and 3—4 in the evening.

If, after three, four, or five weeks' exhibition, signs of considerable improvement in the mixture of the blood are discoverable, and when the appetite, at first too voracious, has subsided to a normal degree, then we may begin to reduce gradually the number of glasses, till, towards the end of the course, they do not amount to more than three or four daily.

γ. A moderate degree of exercise ought to be taken whilst drinking the water. I say moderate exercise, for this alone, and not hurrying about, will facilitate the digestion of the water. It ought to be taken in the open air, if possible, and continued for about half an hour after the last glass <sup>1)</sup>).

δ. As appropriate admixtures for mineral—

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<sup>1)</sup> The importance of exercise is clearly demonstrated by the experiments of Loeffler. He found, that doses of 20 drops of liq. fer. acet. aeth. only then produced griping pains, nausea, eructations, and inclination to vomit, etc. etc., when, immediately after reception, no walk was taken; but that, if brisk motion followed, these manifestations of a lively reaction in the stomach and intestinal tract, did not present themselves at all.



water, we may take milk, especially that of asses, whey, and sometimes, small doses of salts.

Where there is great nervous excitability, our water, on account of the quantity of its carbonic acid, often acts as too powerful an irritant. In such cases, a portion of the gas may be removed by the addition of a little warm water, or by letting the glass of water stand for 10 or 20 minutes, before it is drunk.

At the period of the menstrual courses, the water, in the majority of cases, continues to be drunk; but a smaller quantity is taken. Its use is improper in profuse haemorrhages. Pregnancy offers no absolute counter-indication, but the medical adviser will have to be very attentive to the irritating effect of the carbonic acid.

### §. 36.

c. Regimen to be observed when bathing. In the previous chapters I have communicated in detail the investigations on the subject of the absorptive capability of the skin. This was done, on the one hand, with the view of affording a thorough insight into the effect

of the mineral-baths; on the other, in order to obtain a secure basis for the special prescriptions in their employment.

The baths are used by our patients, in order to cleanse the skin, to promote its vital action, and, chiefly, in order, by this road, to conduct the iron into the blood.

To the attainment of this end, the following rules will be found conducive.

α. The bath must not be too warm. We have seen, that the skin in a bath of  $79^{\circ}$  and  $82^{\circ}$  F. is a greater recipient, than in higher temperatures; that absorption is reduced to a minimum, when the warmth of the bath equals that of the blood; and, that in higher degrees of temperature, not only does the body not absorb, but that it even loses substance in the water.

The bath ought, therefore, to be as cool as possible. I use the expression, „as possible“, because the low degree of individual warmth in the majority of our patients, easily suppresses the necessary re-action towards the skin, when the bath is too cool, and thus causes them to take cold.

At the commencement of the course, let the temperature of the bath be near that of the blood, in no case above it; in cases of great weakness, therefore,  $92 - 97^{\circ}$  F.; of less considerable  $88 - 90^{\circ}$  F. On entering the water, a slight shuddering will probably be observed, but is must soon give way to a comfortable sensation of warmth. In proportion to the improvement of the sanguineous life, cooler baths may be taken, and the diminution of temperature continued, as long as the re-action remains unimpaired (we can sometimes go down to  $77^{\circ}$  and even to  $70^{\circ}$  F.).

In judging of the warmth of the water, the patient should never trust to sensation alone; the thermometer must always be consulted. A bad night's rest, irritation of the nervous system, inconsiderable gastric derangement, variations of the Barometer and Thermometer, make the most vigorous man, and still more the anaemic patient, find a bath, of the same temperature, one day, cold, and the next, warm. A slow and gradual diminution of the temperature is a main requirement in the bathing-course.

β. The patient should not remain too long in the bath. The free carbonic acid of the water, after having penetrated the body, not only excites the nerves of the skin, but also those of the other organs. So long as this excitement is confined within certain limits, it aids the absorptive activity of the skin, as well as the whole process of vegetation. The sudatory canals and sebaceous glands, by the gentle irritation of their nerves, are, at the low temperature of the bath, induced to greater absorption, and a quickened circulation of the blood, as well as an accelerated interchange of substances are the consequences of the animating influence of the carbonic acid on the other nerves.

As every continuous or too intensive irritation of the nervous system is followed by a state of general relaxation, this is also the case by too long a use of baths containing carbonic acid. Giddiness, head-ache, trembling, great lassitude testify, that for the moment, too much has been done. Individuality can alone furnish a criterion in this point; as the shortest and longest terms of duration, we may indicate the period of 5 minutes, gradually increasing it to  $\frac{3}{4}$  of an hour.

γ. Let the bath be taken only when the vascular and nervous systems are in a state of perfect tranquillity. Without taking into consideration the possibility of catching cold by entering a cool bath, when the body is heated, the main object, namely, the absorption of the iron and carbonic acid, can only then be attained, when the capillary system of the skin is perfectly quiet, and the sudatory and sebaceous glandulae are in a state of mean activity. Madden's experiment proves, that absorption ceases, as soon as the body perspires.

The patient ought, therefore, not to take exercise immediately before the bath, which should be had in the course of the forenoon, at a time when the stomach is empty. The hours from 5—12 are equally adapted to this purpose. In the afternoon hours, in consequence of the exercise and nourishment already taken, the vascular and nervous systems are by far less tranquil, than early in the morning after a refreshing sleep.

δ. Let the patient remain quiet, while in the bath. It is important that this



direction should be observed, both in order that the exhaling activity of the skin may not be excited, and that the carbonic acid, which in the form of vesicles settles on the surface of the body, may not be disturbed.

ε. Very weak patients may be allowed, especially at the commencement of the course, to warm themselves in bed, after the bath; and, when the weather is inclement, the same licence may be extended to others. But, in general, it is much better, on leaving the bath, to pass some time in the open air; for it is now that the skin absorbs the oxygen of the air most readily. A moderate degree of exercise is particularly requisite, when the bath has been rather cool.

Circumstances sometimes render additional ingredients to the bath necessary. As adapted to this purpose, we may, in great nervous irritability, prescribe: fresh water, or a decoction of malt or bran; but additions of aromatic, odoriferous herbs I consider to be injurious.

In cases of paralysis, the douche is applied according to the well-known rules. Cold

suffusions, cool and cold hip-baths, as well as cold injections into the vagina and rectum, will be found highly beneficial in atonic conditions of these organs.

During the period of the menstrual flux, bathing ought to be discontinued. The remarks on the internal exhibition of the water during pregnancy, are applicable also here.

### §. 37.

#### d. Dietetic regimen.

α. The aliments must be easy of digestion and nourishing, containing both nitrogen and carbon.

For breakfast, coffee, chocolate, cocoa, with white bread, an egg boiled soft, and perhaps a little meat.

The dinner and supper should be simple, and consist of soup, boiled or rather roast meat, vegetables, light puddings, etc.

Between breakfast and dinner, we may admit a cup of broth.

Not allowed are, all dishes difficult of digestion, as: smoked or salted meat, (with the

exception of raw ham,) pork, roast geese and ducks, eel, salmon, cod, craw-fish, sausage, eggs boiled hard, curdled milk; moreover rich pastry, all farinaceous preparations, (excepting rice and sago puddings,) dried pulse; all sour dishes, fruit in a crude state, cheese, dessert. There can be no objection to a little fresh butter. Tea is allowable. As a beverage at table: a glass of red wine (Asmannshaeusser, Bordeaux, Ingelheimer, Aarbleicher); an old white wine of the Rhine, Moselle, or Palatinate; well-hopped beer; but never mineral-water.

The patient ought not to take too much food at one time; let him rather eat at repeated intervals; and, as the water excites a high degree of appetite, this precept cannot be too strongly impressed upon his mind.

β. Exercise. To be in the open air as much as possible, besides the promenading at the wells, and to take proportionate exercise on foot, in a carriage, on horses or asses, is a primary requisite during the course. But the patient must not be over-fatigued. In the hours of the forenoon, our visitors usually frequent the prome-

nades near the town; the afternoons are devoted to more extended excursions.

γ. The season and temperature of the atmosphere must regulate the clothing; as a general rule it ought not to be too warm. The greater number of our guests, strengthened by the cool baths and pure mountain air, are enabled gradually to substitute lighter garments for those which they wore at the commencement of the course.

δ. All continuous and fatiguing mental exertion is to be avoided, as also every thing that might irritate the nervous system.

### 3. Duration of the course.

#### §. 38.

Heyfelder, in his work upon „Baths and Mineral Courses“ (Bäder und Brunnenkuren) says, page. 9: „To whatever class of mineral-waters the spring, which the patient is to use, may belong, be it intended, by critical excretions of morbid matters to restore the free circulation of the fluids, or, to promote the

energy of the organism, and to remove a direct weakness not resulting from abnormal formations, in both cases can the desired end be attained, and a permanent recovery be brought about, only when the mineral course has been commenced with prudence, continued without precipitation, and not prematurely terminated.“

This opinion of Heyfelder deserves particular notice, especially in regard to those visiting our springs. Every physician is well aware, that patients are often unable to support restoratives, even when such are imperatively necessary, and that tonic medicaments can only then be conveyed in *succum et sanguinem*, when administered in small doses, and with all circumspection adapted to the respective irritability of the organism. This is pre-eminently the case with iron. The greater the debility, the more subtile must be the treatment.

That, under these circumstances, the *cito* is not to be thought of, is a matter of course; and, to make the cure attainable, the treatment must not be prematurely broken off.



The degree of the tenuity<sup>t</sup> of the blood, the magnitude and effect of the dose of mineral-water we find it possible to administer, can alone determine the duration of the course. I cannot here omit requesting foreign physicians, never to give their patients a fixed period of residence at our springs, before the beginning of the course. No one likes to be at a bathing-place, if he is to live by the dictates of medical regimen; every one impatiently anticipates the hour, when he shall be able to quit it and return to his usual occupations; and this is mostly the case with those patients, in whom great debility occasions depression of spirits. If the *terminus usque ad quem* has been first indicated to them, all their calculations are regulated by this decision, and not by the success of the course. The latter is generally discontinued at too early a period, and the change in the mixture of the blood, which often has only commenced, is but of short duration. Let the physician, who entrusts his patient to the care of a professional colleague, place so much confidence in him, as to be assured that his patient's interest, and this alone,

will dictate the arrangement and duration of the course. I should advise every severely afflicted invalid, if his circumstances allow it, to continue the use of the water as long, as it agrees with him.

With saline, weakening springs we may sometimes go too far; but with ferruginous acidulae, if due attention be paid by the professional attendant, this is not possible.

During the exhibition of our waters there occurs, in the literal sense of the term, a point of saturation, that is not to be mistaken. Beyond this limit we must not go. — It has already been mentioned, that it is the principal task of the bath-physician, carefully to proportion the doses to the degree of individual nervous irritability. It is not only the dose of each day, which is here alluded too, but also that of the whole period of treatment. A continuous and harmonious relation must be established between the quantity of substance introduced and the vital action. If the former be too abundant, it will exercise an injurious influence on the latter.

This injurious influence is partly attributable to a superabundance of substances containing

nitrogen, but more especially to the heightened process of combustion in the blood.

The symptoms which characterise the point of saturation, are first of all the phenomena of hyperoxydation of the blood.

These are: general excitement, easily getting tired, sleeplessness, re-appearance of suppressed morbid manifestations, giddiness, head-ache, bleeding at the nose, palpitations of the heart, anxiety; we may add decrease of appetite, and a repugnance to the mineral-water, which, formerly, was taken with predilection.

In Loeffler's experiment the symptoms recorded under this head are: a heaviness in the head, confusion in the region of the forehead, pressure in both temples, a sensation of exuberant fulness in the head, violent bleeding at the nose, oppression of the chest, slight pricking pains in the lungs, tension in the region of the heart, spitting of blood, lassitude in the limbs, diminution of appetite, pressure in the stomach after eating, etc. At first these symptoms are considerable; but they are soon

aggravated, and may produce febrile attacks, inflammation and nervous cramps.

The symptoms of hyperoxydation present themselves, as soon as the blood is brought back to a normal mixture (the point of saturation); but they occur earlier, if the course has not been conducted with due caution.

In the first of these cases, the course ought to be concluded immediately (it occurs generally after a use of 5 — 7 weeks); in the second, a pause must be made, and when the storm has abated, the course may be resumed.

But it is far preferable, that such appearances should be prevented by cautious exhibition of the iron, and, particularly, by making short pauses from the very commencement of the cure, wherever irritation is to be apprehended. The bath may be prescribed only every other day, and after 2, 3 or 4 baths, a day of rest should be granted, and still longer pauses, after a continued use of the waters.

The opinion just stated, is diametrically opposed to the still widely diffused belief, that our mineral-water must be exciting in its effects. The prevalence of this idea, from which

even medical men are sometimes not wholly free, cannot be too much regretted.

The object of our water, is gradually to promote vegetative life in a bland and tranquil manner, and, in conjunction with the reciprocal effect of the vascular and nervous systems, to give substance and energy to the body. As in the stage of convalescence from an acute disease, all excitement must be avoided, and nothing but the restitution of lost substance be effected. And if, after a continuous and prudent exhibition, a re-action is manifested, then is the time to pause, or to cease altogether. This re-action (provided it be not grounded on any other transient contingency, such as impurity of the *primae viae*, cold, etc.) serves as a sign, that, for the present, a sufficiency of tonic elements has been conveyed into the blood, and that the relaxed nervous system is not capable of taking charge of more.

Critical excretions are, among our patients, to be expected only in those rare cases, in which foreign substances have been mixed with the blood. They consist in papulous cutaneous eruptions, and sediment in the urine.



A repetition of the course in succeeding years, is often necessary in inveterate, and particularly innate conditions of debility.

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#### IV. Treatment after a course of the Schwalbach waters.

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##### §. 39.

When, by proper preparation and a judicious use of the waters, the composition of the blood has been brought back to a normal state, and local complaints have been removed, the patient must, for some time afterwards, endeavour to avoid the noxious principles, which were the cause of his disease. The convalescent should, therefore, not return immediately to his former employment or domestic relations, but sojourn for some weeks in the country, and observe the same dietetic rules, which had been prescribed during the course.

Unfortunately, there are but few of our guests, who are able to devote a whole summer to the recovery of health; and, it is only with difficulty, that the majority can allow

themselves to sacrifice a few weeks to that purpose. The course being terminated, they are immediately re-exposed to the noxious causes of disease, and the consequence is, that the effect of the waters, is, in part, directly neutralised. Yet there are but few among them, who could not find time for a walk of an hour, or an hour and a half daily; and, if the weather in any way allow it, this exercise ought never to be omitted. — If great irritability of the nervous system or of the skin previously existed, cold ablutions of the whole body, immediately after rising, will be found highly beneficial, on concluding the course. After having been accustomed to the cool baths, the cold washings will be easily supported, and if exercise be taken immediately after, the patient will not be exposed to catching cold. A glass of fresh, cold water, taken fasting during the autumn and winter, is here much to be recommended, especially when the digestive organs had been much weakened.

If the cure has not been regularly concluded, it will be advisable, that the patient should drink the mineral-water in small doses (per-

haps  $\frac{1}{2}$  a stone-bottle), for some weeks after leaving the wells. It should be taken in the morning hours, with observation of the accustomed regimen, and I should recommend him to take a proper number of freshly-filled bottles from here.

Owing to the close combination of the carbonic acid gas with the water, to the very careful method of filling and corking, as well as to the excellent quality of the bottles intended for exportation, the Schwalbach mineral-water can be kept much longer than other ferruginous waters, and is, therefore, peculiarly adapted to a short after-cure at a distance from the spring.

In order to fortify the skin and nerves, cold sea- and fresh-water baths, taken for a few minutes, may be of the greatest service.

In cases, where foreign substances had been mixed with the blood, as in the anaemia of miners, metallic poisoning, etc., considerable advantage may be derived from a moderate grape-cure of several weeks.

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